

# **Recreational Development Capacity Study of Twelve Lakes in the South Riding Mountain Planning District (1985)**

By A.E. Beck



RECREATIONAL DEVELOPMENT CAPACITY STUDY OF  
SOME LAKES IN THE SOUTH  
RIDING MOUNTAIN PLANNING DISTRICT (1985)

A. E. Beck  
Water Standards and Studies Section  
Environmental Management Services Branch  
Environmental Management Division

Department of Environment and Workplace Safety and Health

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### SUMMARY

The South Riding Mountain Planning District Board requested that recreational development capacity studies be conducted on twelve lakes located within the Planning District. The Board's goal was to develop guidelines for recreational development such that lake water quality was maintained, that the aesthetic appeal of the area was not impaired and that prospective water based recreational activities could be safely accommodated.

The study commenced in July 1985 as a joint effort between the Board and Water Standards and Studies Section of the Manitoba Department of Environment and Workplace Safety and Health. Board responsibilities included sample collection and provision of required background information. The responsibilities of Water Standards and Studies Section included sample analysis, data interpretation and report preparation. Interpretive aids and applied procedures included assessment of trophic status, identification of problem nutrients, development and validation of phosphorus budgets and calculation of cottage capacities and boat capacities.

The results obtained from seven of the lakes studied were particularly successful from the viewpoint of achieving study goals. Although considerable advances were made in understanding the limnological characteristics of the remaining five lakes, the results obtained precluded full achievement of study goals set for these waterbodies. Results and recommendations derived for each of the lakes are summarized individually.

Ditch Lake was found to be an eutrophic waterbody. The water quality was generally suitable for recreational purposes except during major algae blooms. Algae and weed growth in the lake was controlled by phosphorus availability. The phosphorus loading rate was excessive and had induced a long term deterioration in water quality. The development capacity of Ditch Lake had been exceeded by approximately 500% and this continued to exacerbate the problem of water quality deterioration. Boating capacity for the lake had also been greatly exceeded and this created a significant potential for conflict between various water based recreational activities, including the risk of a serious boating accident. It was recommended that further development not be permitted and that local authorities consider imposing restrictions on power boats. In order to decelerate water quality deterioration, it was also recommended that recreationers and local landowners be encouraged to install wastewater holding tanks and to plant tree and shrub buffer zones.

Kerr Lake was found to border on the eutrophic state. The water quality was generally suitable for recreational purposes except during particularly severe algae blooms. Similar to Ditch Lake, phosphorus availability controlled algae and weed growth. The background phosphorus loading rate was excessive and had induced a slow deterioration in water quality. Kerr Lake had some potential to

accommodate additional development without detectably affecting water quality. Thus it was recommended that future development at Kerr Lake not exceed a lake total of 33 additional cottage equivalent units. These latter were to be calculated at the rate of 1 cottage = 0.147 residences = 1.10 campsites/day use sites. Neither present utilization nor the recommended maximum allowable additional development cause the lake boating capacity to be exceeded.

Both Otter Lake and Little Jackfish Lake were found to be hyper-eutrophic. This means that the water quality generally is not considered suitable for body contact recreational purposes. Nitrogen availability controlled algae and weed growth in Little Jackfish Lake while either nitrogen or phosphorus controlled production in Otter Lake. Significant conflicts between various water based recreational activities are unlikely at present rates of utilization of these waterbodies. The data obtained during the present study was insufficient for development capacity predictive purposes. Thus it was recommended that the limnological study of Otter Lake and Little Jackfish Lake be extended for another year and that decisions affecting development proposals for these lakes be postponed until completion of the extended studies.

Sandy Lake was found to be an eutrophic lake. The water quality generally is considered suitable for recreational purposes except during major algae blooms. Phosphorus availability controlled algae and weed production in the lake. Significant conflicts between various water based recreational activities are unlikely even at the present moderate to heavy rate of utilization by boats. Similar to Otter and Little Jackfish Lakes, the data obtained was insufficient for development capacity predictive purposes. Again it was recommended that the limnological study be extended for another year and that decisions affecting development proposals be delayed until study completion.

Both Crawford Lake and Thomas Lake were found to be mesotrophic waterbodies. The water quality of each was considered suitable for recreational purposes. Either nitrogen or phosphorus availability could alternate as the nutrient controlling algae and weed production on these lakes. The phosphorus loading rates to both lakes were excessive, with that of Crawford Lake being particularly high. Due to background phosphorus loadings, the water quality of both lakes was expected to continue to slowly deteriorate over time. The current degree of development at Thomas Lake approximates capacity and it was recommended that further development not be permitted. However, Crawford Lake had some potential to accommodate additional development without detectably affecting water quality. Thus it was recommended that future development at Crawford Lake not exceed a lake total of 19 additional cottage equivalents. These latter were to be calculated at the rate of 1 cottage = 0.147 residences = 1.46 campsites/day use sites. It was also recommended that Crawford Lake landowners and recreationers be encouraged to establish tree and shrub buffer zones around the lake to reduce the excessive rate of phosphorus loading.

Czornyj Lake was found to be eutrophic and the water quality was generally considered suitable for recreational purposes except during major algae blooms. Phosphorus availability controlled algae and weed growth in the lake. The phosphorus loading rate was excessive and had induced a long term deterioration in water quality. Czornyj Lake also had some potential to accommodate additional development without detectably affecting water quality. Thus it was recommended that future development not exceed a lake total of 11 additional cottage equivalent units. These latter were to be calculated at the rate of 1 cottage = 0.147 residences = 1.10 campsites/day use sites.

Both Dummy Lake and Stewart Lake were found to border on the eutrophic state. The water quality of each lake was generally considered suitable for recreational purposes except during particularly severe algae blooms. Either nitrogen or phosphorus availability could limit production in these lakes. Significant conflicts between various water based recreational activities are unlikely at present rates of utilization by boats. Similar to Otter, Little Jackfish and Sandy lakes, the data obtained for Dummy Lake and Stewart Lake was insufficient for development capacity predictive purposes. Thus it was recommended that the limnological studies of these waterbodies be extended for another year and that decisions affecting development proposals for Dummy and Stewart lakes be postponed until completion of the extended studies.

Imrie Lake was also found to border on the eutrophic state. The water quality was generally considered suitable for recreational purposes except during particularly severe algae blooms. Phosphorus availability controlled production in the lake. The phosphorus loading rate was on the verge of becoming excessive but had not yet induced severe water quality deterioration. The water quality is particularly susceptible to land surface disruption within the immediate watershed because of the present finely balanced status of the lake. Nevertheless, Imrie Lake had some potential to accommodate additional development without detectably affecting water quality. Thus it was recommended that future development not exceed a lake total of 28 additional cottage equivalent units. These units were to be calculated at the rate of 1 cottage = 0.147 residences = 1.12 campsite/day use site. Due to the sensitivity of the lake, it was also recommended that proponents of future developments be encouraged to exercise extreme care in the matter of land surface disruption.

Seech Lake was a mesotrophic waterbody. Accordingly, the water quality was considered suitable for recreational purposes. Similar to the other mesotrophic lakes, either nitrogen or phosphorus availability could limit algae and weed production. Due to background phosphorus loading rates, the water quality was expected to continue to slowly deteriorate over time. The boat capacity of the lake has been substantially exceeded and this currently restricts further development. Seech Lake has the potential to accommodate some additional development without inducing detectable water quality deterioration providing that allowance is made for the excessive

boating potential. Thus it was recommended that future development not exceed a lake total of 26 additional cottage equivalent units. These units were to be calculated at the rate of 1 cottage = 0.147 residences = 0 campsites/day use sites. In order to reduce the significant risk of a serious boating accident or other water based recreational conflict, it was also recommended that local authorities consider prohibiting the use of motorized craft in the lake.

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## 1.0 INTRODUCTION

The South Riding Mountain Planning District (Figure 1) is comprised of four municipal jurisdictions, including the Rural Municipalities of Clanwilliam, Harrison, Strathclair and the Local Government District of Park (Municipal Affairs, 1985). The Planning District abuts the south perimeter of Riding Mountain National Park. Proximity to the Park, in combination with a rolling topography studded with scenic pothole lakes, has proven to be an attraction for drawing cottagers and other recreationers to the District. The influx of cottagers and other recreationers to a predominately agricultural area, as well as the demand for additional development, has coincided with some resource allocation conflicts. The conflicts are classic and involve dynamic interactions between three viewpoints. These viewpoints include the traditional rights of land owners respecting usage and development, the public demand for additional recreational opportunities and development, and the general citizen's concern that the environment not be degraded. Fortunately, the potential problems associated with the failure to reconcile conflicting viewpoints have been recognized by the Planning District Board\* at a relatively early stage in development of the District.

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\* The Planning District Board is composed of representatives from each municipal jurisdiction, Mr. Wally Dmyterko (Secretary-Treasurer) and Mr. Terry Pearce (Land Use Planner, Department of Municipal Affairs).

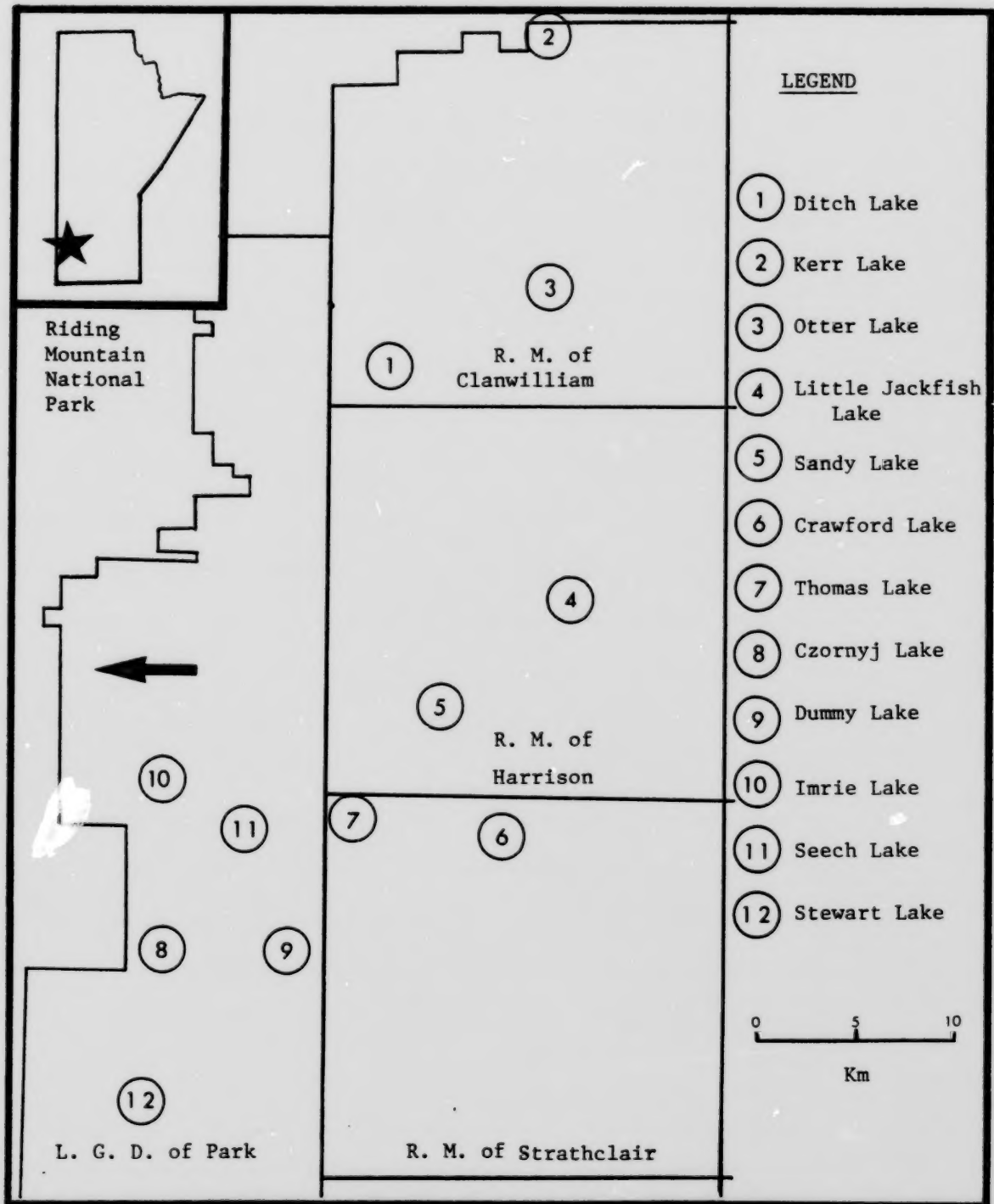


Figure I: The South Riding Mountain Planning District.

Environmental Management Division involvement with recreational development conflicts within the Planning District may be traced to 1977. A petition seeking to restrict further development on North Thomas Lake was received by the Minister of (then) Mines, Resources and Environmental Management (Environmental Management Division files). A trophic assessment study was launched by the Division in response to the 1977 petition. A second petition, also seeking to restrict further development on North Thomas Lake, was received by the Minister of (then) Consumer and Corporate Affairs and Environment in September, 1980 (Ibid). A formal report was prepared (Brown and Beck, 1980) and released in response to the petition. More recently Mr. G. Pederson, Chairman of the Planning District Board, in a letter dated December 19, 1984 requested that development capacity studies be undertaken on a number of lakes situated within the Planning District (Appendix I(a)). The letter of response (Appendix I(b)) indicated that resources were unavailable for field activity due to prior commitments, but that professional expertise for data interpretation and report preparation could be made available if samples were collected through the Planning Board. Subsequent to a number of telephone conversations and several meetings, funding for field staff was obtained by the Planning District Board from "Career Start '85" and the design of the study was finalized. Project field work commenced on July 2, 1985.

The intent of the present study was to develop a scientifically sound compromise between the three conflicting viewpoints. Recommendations were to be made regarding further

recreational development, thereby allowing land owners to consider subdivision of property. This was subject to the proviso that detectable water quality degradation would not occur as a result of the development. The specific objectives of the study were:

1. To determine the trophic status of twelve selected lakes;
2. To develop specific recommendations with respect to the cottage carrying capacity of the twelve selected lakes.

The study was not intended to develop an itemized management proposal detailing the exact nature of future developments. The study was intended to imply that further ameliorative action could be undertaken to improve existing water quality.

The key criteria upon which the recommendations were to be based included the maintenance of environmental quality, aesthetic considerations and the safety of recreationers.

## 2.0 METHODS

### 2.1 Rationale

The primary objective of the study was to develop specific recommendations regarding the cottage carrying capacity of twelve lakes located within the South Riding Mountain Planning District. The key criteria cited by Pederson (Appendix I(a)) included environmental quality, public safety and aesthetic considerations. The criteria, though interdependent, required slightly differing avenues for evaluation.

Maintenance of environmental quality is perhaps the most basic or critical of the criteria. The literature (Vollenweider, 1968; Vallentyne, 1974) leaves little doubt that overdevelopment along aquatic systems results in an accelerated rate of eutrophication. Accelerated eutrophication, or rapid aging of a lake is caused by increased nutrient loading and is manifested by such symptoms as numerous algae blooms, excessive macrophyte growth and frequent fish die-offs. Classic whole lake experiments have implicated phosphorus overabundance as the trigger for accelerated eutrophication (Schindler et al, 1971; Schindler, 1977). Applying these principles to the present study, maintenance of environmental quality required that phosphorus loadings from potential and/or existing developments could not significantly exceed the background rate of phosphorus loading. This meant that emphasis had to be focused upon the development of an accurate phosphorus budget for each of the lakes. Permissible rates of development could then be calculated using appropriate margins of safety or error.

Safety considerations were viewed from the perspectives of public health and mechanical or physical safety. The health perspective focused upon the prevention of potential surface water contamination by human wastes. The strategy for this endeavour is already well established and is embodied in the various regulations pertaining to the proper installation and maintenance of sewage disposal systems such as septic fields and holding tanks. The mechanical safety perspective focused upon prevention of boat collisions and near collisions. This was achieved by applying "crowding" criteria developed by Thomas (1983).

Aesthetic considerations are particularly difficult to evaluate. The strategy adopted in this report was based upon the assumption that current conditions, though not ideal, were acceptable to recreationers of the area. This required that existing quality be quantified such that the full range of conditions which might be experienced were determined. This meant that the trophic status of each lake had to be assessed. The strategy also required that the existing environmental quality not be permitted to deteriorate. This aspect was included as a prerequisite in the error or safety margin factor of the permissible rate of development calculations.

## 2.2 Field Procedures

A rigorous water sampling regime was implemented on each of the lakes in order to assess the validity of the phosphorus budget. The primary intent of the field sampling program was to provide an

estimation of the mean total phosphorus concentration [P] at an accuracy level indicated by a mean standard error of less than 10% of the mean. Hence, the water sampling regime was based on a strategy of stratified random sampling (Cassie, 1971). Based upon previous investigations (Water Standard and Studies, unpublished data), the number of sampling stations was set at three, summer sampling frequency was set at once weekly and fall and winter sampling frequency was set at once per term. Sampling stations (Appendix II) were located arbitrarily at middle and opposite end points on the lake. Sampling depths were determined by considering random numbers a percentage of total depth at each station.

Samples at depth were collected using a 2.2 L pesticide grade acrylic Kemmerer sampler. Depth integrated chlorophyll "a" samples were collected at a maximum of twice the Secchi depth by using a Water Standards and Studies sampler. Instruction in proper sampling technique was provided to Mr. Bob Philipation and Miss Sherri Dmyterko, both students resident in the area who collected the summer samples (324 samples). Fall and winter sampling (72 samples) was conducted by Water Standards and Studies.

All samples were shipped by scheduled bus service to the W. M. Ward Technical Services Laboratory so as to arrive within twenty-four hours of collection. Analyses were performed at the laboratory according to procedures described by Sorba et al (1980).

### 2.3 Identification of the Problem Nutrient

A nutrient will be consumed by aquatic vegetation at a rate proportional to the need for that nutrient (Rast and Lee, 1978). Hence, the growth of aquatic vegetation is limited by the nutrient which is available to it in the minimal quantity relative to its needs for growth or reproduction (Ibid). The nutrient most likely to limit productivity can be determined by a "demand:supply" ratio (Vallentyne, 1974). Alternately, the nutrient which is present in large quantities during periods of excessive aquatic vegetation growth is not limiting the growth of that macrophyte (Rast and Lee, 1978).

The demand:supply ratio may be quantified on the basis of actual vegetational requirements. The atomic ratio of nitrogen:phosphorus (i.e N:P) present in mixed phytoplankton averaged 16:1 (Redfield et al, 1963; in Rast and Lee, 1978). The atomic ratio for algae common to ponds and lakes in the south-eastern United States averaged 24:1 (Rast and Lee, 1978). Converting the atomic ratios to mass or weight (atomic weight of nitrogen = 14.01; atomic weight of phosphorus = 30.97), yields a mass N:P ratio of 7.24 mg N:1 mg P for mixed phytoplankton and 10.86 mg N:1 mg P for algae, respectively. This meant that N:P mass ratios less than the 7.24 to 10.86 range indicated that nitrogen was the limiting nutrient. Alternately, N:P mass ratios greater than the 7.24 to 10.86 range indicated that phosphorus was the limiting nutrient.

Assuming that all nitrogen and phosphorus present in the water during the summer could theoretically be utilized by aquatic vegetation, a ratio of total Kjeldhal nitrogen (TKN) to total

phosphorus (TP) would yield a theoretical mass N:P ratio. However, not all of the total nitrogen and phosphorus present are in forms readily available for use by aquatic vegetation. Cowen and Lee (1976) demonstrated that up to 30% of the total phosphorus can be converted to usable phosphorus (i.e. soluble orthophosphate\*) in about 20 days. Cowen et al (1976) showed that up to 70% of organic nitrogen (i.e. total Kjeldhal nitrogen) can be converted to usable forms (ammonia, nitrate and nitrite) in 35 to 50 days. Application of these qualifiers  $((TKN \times 0.70)/TP \times 0.30)$  modified the N:P ratio to yield a potentially available mass N:P ratio. A third estimation of the mass N:P ratio was derived from Hutchinson's (1957) estimate that 10% of total phosphorus present in natural water is comprised of soluble orthophosphate (i.e. readily available to aquatic vegetation). Utilizing the sum of ammonia, nitrate and nitrite and the qualified phosphorus,  $(TP \times 0.10)$  yields a calculated mass N:P ratio. Each of the mass ratios (i.e. theoretical mass ratio, potentially available mass ratio and calculated mass ratio) was then compared to the acceptable range.

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\* The soluble orthophosphate fraction was not determined in the present study because field preservation techniques are cumbersome and even relatively short terms of storage of preserved samples (i.e. <8 days) yield wide fluctuations in analytical results (El-Shaarawi and Neilson, 1984).

#### 2.4 The Phosphorus Budget

The phosphorus budgets for the South Riding Mountain Planning District lakes were developed with the aid of a variety of models and data sources. The calculation process was itemized (Table 1) and discussed in a step by step fashion after the manner of Hough, Stansbury and Michalski Limited (1980).

##### Step 1:

Estimation of the gross drainage basin area is a standard hydrological procedure (Gray, 1970) wherein the high points of land surrounding the lake are outlined on a topographic map. It is assumed that both surface water and groundwater flow downhill as indicated by topographic contour lines. The gross drainage areas for the lakes were measured with an Alpha p-27 polar planimeter. The watersheds were not segregated by land use type as recommended by Hough, Stansbury and Michalski Limited (1980) since the results indicated that the proximity of tilled agricultural land to the lakes' shoreline was of greater significance than its extent in the watersheds.

##### Steps 2 and 3:

Estimation of lake surface areas is a standard limnological procedure (Welch, 1948). Surface areas were measured by planimetry on 1:50,000 NTS maps.

TABLE 1: CALCULATION PROCESS FOR THE SOUTH RIDING PLANNING DISTRICT LAKES PHOSPHORUS BUDGETS.

| STEP | PARAMETER                                                                                                          | QUANTITATION                      |
|------|--------------------------------------------------------------------------------------------------------------------|-----------------------------------|
| 1.   | Gross Drainage Basin (A)                                                                                           | $\times 10 \text{ m}^2$           |
| 2.   | Lake Surface Area (Ao)                                                                                             | $\times 10 \text{ m}^2$           |
| 3.   | Surface Area of Other Lakes in A (Ao <sub>1</sub> )                                                                | $\times 10 \text{ m}^2$           |
| 4.   | Drainage Basin (Ad = A - [Ao + Ao <sub>1</sub> ])                                                                  | $\times 10 \text{ m}^2$           |
| 5.   | Lake Volume (V)                                                                                                    | $\times 10 \text{ m}^3$           |
| 6.   | Lake Mean Depth (Z = V/Ao)                                                                                         | m                                 |
| 7.   | Net Annual Runoff (r)                                                                                              | 0.051 m/yr                        |
| 8.   | Net Annual Evaporation (E <sub>v</sub> )                                                                           | -0.130 m/yr                       |
| 9.   | Outflow Q = [Ad·r] + E <sub>v</sub> ·[Ao + Ao <sub>1</sub> ]                                                       | $\times 10 \text{ m}^3/\text{yr}$ |
| 10.  | Flushing Rate (p = Q/V)                                                                                            | times/yr                          |
| 11.  | Areal Water Load (qs = Q/Ao)                                                                                       | m/yr                              |
| 12.  | Retention Coefficient (R = 13.2/13.2 + qs)                                                                         |                                   |
| 13.  | P Loading Rate for Precipitation (L <sub>Pr</sub> )                                                                | 41 mg/m <sup>2</sup> /yr          |
| 14.  | P Contribution from Precipitation (J <sub>Pr</sub> = L <sub>Pr</sub> ·Ao)                                          | $\times 10 \text{ mg/yr}$         |
| 15.  | P Export Coefficient (E)                                                                                           | 23.3 mg/m <sup>2</sup> /yr        |
| 16.  | P Contribution from Drainage Basin (J <sub>D</sub> = E·Ad)                                                         | $\times 10 \text{ mg/yr}$         |
| 17.  | Total P from Natural Sources (J <sub>N</sub> = J <sub>Pr</sub> + J <sub>D</sub> )                                  | $\times 10 \text{ mg/yr}$         |
| 18.  | P Contribution per Capita Year (S)                                                                                 | 8.0 x 10 <sup>5</sup> mg/yr.      |
| 19.  | Sewage Treatment Retention Coefficient (R <sub>S</sub> )                                                           | 0.63                              |
| 20.  | Total Campground Site Units (U)                                                                                    | units                             |
| 21.  | Mean Persons per Unit (P)                                                                                          | 1.51 persons/unit                 |
| 22.  | Mean Season Length (SL)                                                                                            | 85 days                           |
| 23.  | Campground Capita Years (N <sub>CY</sub> ' = [U·P·SL]/365)                                                         | capita years                      |
| 24.  | P Contribution from Campground (J <sub>A</sub> ' = S·N <sub>CY</sub> '[1-R <sub>S</sub> ])                         | $\times 10 \text{ mg/yr}$         |
| 25.  | Number of Cottages (N <sub>C</sub> )                                                                               | units                             |
| 26.  | Capita Years per Cottage (P <sub>C</sub> )                                                                         | 0.63 capita years                 |
| 27.  | Number of Residences (N <sub>D</sub> )                                                                             | units                             |
| 28.  | Capita Years per Residence (P <sub>D</sub> )                                                                       | 4.3 capita years                  |
| 29.  | Total Occupant Capita Years (N <sub>CY</sub> " = P <sub>C</sub> ·N <sub>C</sub> + P <sub>D</sub> ·N <sub>D</sub> ) | capita years                      |
| 30.  | P Contribution from Occupants (J <sub>A</sub> " = S·N <sub>CY</sub> "[1-R <sub>S</sub> ])                          | $\times 10 \text{ mg/yr}$         |
| 31.  | Total P from Artificial Sources (J <sub>A</sub> = J <sub>A</sub> ' + J <sub>A</sub> " )                            | $\times 10 \text{ mg/yr}$         |
| 32.  | Total P Supply (J <sub>T</sub> = J <sub>N</sub> + J <sub>A</sub> )                                                 | $\times 10 \text{ mg/yr}$         |
| 33.  | Predicted Spring Total P Concentration (P = [J <sub>T</sub> (1-R)]/Q)                                              | mg/L                              |

Step 4:

The surface areas of the lakes with proportionately small watersheds are excluded from estimations of drainage basin area due to the dynamics of evaporation (Hough, Stansbury and Michalski Limited, 1980).

Step 5:

Estimation of lake volume is a standard limnological calculation based upon lake contour maps and planimetry (Welch, 1948). Contour maps of nine of the Planning District lakes were provided by Manitoba Natural Resources\*. Contour maps of Ditch, Little Jackfish and Otter Lakes were developed by Water Standards and Studies from soundings conducted in late October, 1985. A Furuno Mark IV unit was used for these echo soundings.

Step 6:

Estimation of mean depth is a standard limnological calculation (Welch, 1948).

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\* Courtesy of Brian Yake, Resource Technician, Southwestern Fisheries Region; Manitoba Natural Resources.

Steps 7 and 8:

Estimates of net annual runoff and net annual evaporation rates for Thomas Lake were provided by Mudry\* (pers. comm.; Appendix III(a)). Since Thomas Lake is central to the Planning District, the runoff and evaporation rates were extrapolated to all lakes of the Planning District.

Steps 9, 10 and 11:

These calculations are standard load estimation procedures (Hough, Stansbury and Michalski Limited, 1980).

Step 12:

The empirical formula for estimating the relative amount of phosphorus unavailable for dispersion through the water column was provided by Dillon (no date) in Hough, Stansbury and Michalski Limited (1980). The equation replaces that proposed by Dillon and Kirchner (1975).

Steps 13 and 14:

Atmospheric contribution of phosphorus can be very significant in lakes with small drainage basins (Schindler et al, 1976). Values reported by Schindler et al (1978) ranged from 24 to 53 mg/m<sup>2</sup>/year for the Experimental Lakes Area near Kenora, Ontario.

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\* N. Mudry, P. Eng. Director of Planning, Water Resources Branch; Manitoba Natural Resources.

Experimental measurements of aeolian phosphorus contributions conducted near Brandon, Manitoba (Appendix III(b)) indicated loading rates up to  $82 \text{ mg/m}^2/\text{year}$  (M. Bennett, pers. comm.\*). Considering the values reported for the Experimental Lakes Area, it was deemed not unreasonable to adopt the arithmetic mean of the Brandon values (i.e.  $41 \text{ mg/m}^2/\text{year}$ ) for the present study. Estimation of the total atmospheric contribution to each lake was calculated as the rate per square metre multiplied by total surface area of the lake.

Steps 15 and 16:

Dillon and Kirchner's (1975) mean total phosphorus export coefficient for a sedimentary watershed devoted to mixed forest and pasture usage was adopted for the present study. The total natural phosphorus contributed by the watershed was then estimated by the export coefficient multiplied by total area of the drainage basin. Provision for excluding the phosphorus fraction retained in the water columns of upstream waterbodies after the manner of Hough, Stansbury and Michalski Limited (1980) was not made, because the fractions retained in the water columns of lakes in the present study were not significant in proportion to the total phosphorus load (i.e.  $1-R = <5\%$  of Total Phosphorus).

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\* M. Bennett, Special Projects Coordinator, Air Standards and Studies, Manitoba Environment and Workplace Safety and Health.

Step 17:

The total phosphorus supply from natural sources may be estimated by summing contributions from the drainage basin outflow and from the atmosphere.

Step 18:

The value recommended by Hough, Stansbury and Michalski Limited (1980) has been adopted.

Step 19:

Surficial deposits of the Planning District are primarily glacial and glacial-fluvial in origin (Jenkins, 1970). The deposits generally consist of coarse materials such as sand, gravel, cobble and boulders as well as finer materials such as silts and clays (Ibid). This heterogeneity infers that soil retention coefficients of total phosphorus may differ substantially even on a very localized basis. Therefore, a relatively medial coefficient, that for silty sand, was adopted from the work of Brandes et al (1974).

Step 20:

The estimate of campground site units available was derived by Water Standards and Studies following site inspection during summer, fall and winter sampling periods. Factors considered included actual use observed, comments provided by Mr. Wally Dmyterko (pers. comm.), facilities available, area available for use and site aesthetics.

Step 21:

An estimate of the mean number of persons per camping unit was not available for either the Planning District or Manitoba in general. The present estimate was derived from the Hough, Stansbury and Michalski Limited (1980) mean of 4.30 capita years at permanent homes, multiplied by 0.352, the mean Western Region campsite occupancy ratio (Manitoba Natural Resources, 1985). Although the mean campsite ratio may be somewhat high for campgrounds of the Planning District, its present use is justified as a way of accounting for loadings due to beach day users and both summer and winter angling activity.

Step 22:

The 1985 season length was estimated on the basis of weekends from May 5 to June 21, and daily thereafter to September 2 (inclusive).

Steps 23 and 24:

Formulae for these calculations were derived from Hough, Stansbury and Michalski Limited (1980).

Step 25:

Counts of the cottages present at each lake were provided by Mr. Wally Dmyterko (pers. comm.). Note that in some instances (example, Ditch Lake), cottages equipped with holding tanks have been excluded from the total for the lake. This is because holding tanks effect a net export from the watershed of that cottage's total phosphorus load (Hough, Stansbury and Michalski Limited, 1980).

Step 26:

The absence of specific data for Manitoba necessitated adoption of the values provided by Hough, Stansbury and Michalski Limited (1980).

Step 27:

Residences were defined as occupied farm homes located within approximately 250 metres of the lake shore. Counts were provided by Water Standards and Studies.

Step 28:

The values provided by Hough, Stansbury and Michalski Limited (1980) were adopted.

Steps 29, 30, 31, 32 and 33:

Calculations were performed according to formulae presented by Hough, Stansbury and Michalski Limited (1980).

2.5 Budget Validation

Budget validity may be assessed either by actual observation or by theoretical means. Since temporal constraints prevented actual measurement of spring phosphorus concentrations over a series of years, actual spring observations could not be used for budget validation. Theoretical budget validation was achieved by calculations drawn from the literature. The process involved algebraic manipulation of established formulae in order to isolate

the spring phosphorus concentration as a variable. The equation was then solved by substitution of measured values for remaining variables.

The classic equation defining the summer chlorophyll a concentration ([Chla]) to spring total phosphorus concentration ([TP]) relationship in north temperate lakes developed by Dillon and Rigler\* (1974) was:

$$\text{Eq. 1a: } \log_{10}[\text{Chla}] = 1.449 \log_{10}[\text{TP}] - 1.136$$

The equation may be manipulated to isolate the [TP] variable as follows:

$$\text{Eq. 1b: } \log_{10}[\text{TP}] = (\log_{10}[\text{Chla}] + 1.136) / 1.449$$

A second equation defining the [Chla]-[TP] relationship in north temperate, shallow mixed lakes was recently developed by Riley and Prepas (1985)\*. This equation was:

$$\text{Eq. 2a: } \log_{10}[\text{Chla}] = 1.251 \log_{10}[\text{TP}] - 0.680$$

The equation may be manipulated to isolate the [TP] variable as follows:

$$\text{Eq. 2b: } \log_{10}[\text{TP}] = (\log_{10}[\text{Chla}] + 0.680) / 1.251$$

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\* [Chla] and [TP] are expressed as mg/m<sup>3</sup>

Validation using the Dillon and Rigler (1974) and Riley and Prepas (1985) formulae assumes that chlorophyll a production is neither unduly inhibited nor significantly enhanced. The data suggested that some enhancement or inhibition had occurred on certain lakes. Therefore, it was necessary to test the accuracy of chlorophyll a values with respect to interdependent parameters. Carlson's (1977) indices based upon summer values for chlorophyll a, total phosphorus and Secchi disk values were adopted for this purpose. An average of the three indices (per lake) was calculated and the single occurrence of an index value beyond the limit of  $\pm 10\%$  of average was considered arbitrary cause for rejection\*. This meant that chlorophyll a concentrations were unsuitable for budget validation on lakes where the range of TSI indices exceeded 20% of an average value.

Assuming that chlorophyll a concentrations were deemed suitable for validation purposes, analytical and regression uncertainties required the setting of acceptable range limits. An acceptable range about the predicted spring phosphorus concentrations (Table 1), was based upon analytical uncertainties and statistical probability\*. This meant that the 10% analytical uncertainty at 0.01 mg/L (Sorba et al, 1980) corresponded to a  $\pm 20\%$  range.

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\* Justification for arbitrary usage of the "10%" value is based in the statistical axiom that two units of standard deviation correspond to a probability of approximately 95.4%.

Acceptable range limits about the calculated theoretical phosphorus concentrations (equations 1(b) and 2(b)) were derived from the correlation coefficients of Dillon and Rigler (1974) and Riley and Prepas (1985). These required uncertainties of  $\pm 5\%$  and  $\pm 17\%$ , respectively. Phosphorus budgets were considered valid when predicted spring phosphorus concentrations fell within the acceptable range as defined by equations 1(b) and 2(b).

The error bounds for theoretical validations are of necessity quite wide. An alternate approach to budget validation considers water column phosphorus concentrations during late fall and winter. This approach is based upon observation of local pothole lakes published by Barica (1977). Generally, he observed that total phosphorus concentrations were greatest prior to spring breakup (i.e. prior to ice melting and consequently prior to the growth of aquatic vegetation and the proliferation of plankton) and that they declined over the summer months as nutrients became trapped within the tissues of the aquatic biota. During fall and winter months, phosphorus was restored to the water column from organic detritus and the sediments by both aerobic and anaerobic mechanisms. Relevant to the present study, however, was the observation that summer phosphorus concentrations differed from winter concentrations. Furthermore, fall and winter concentrations better approximated pre-breakup maximums than did summer values. This meant that fall and winter concentrations observed during the present study were better suited for estimation of spring concentrations. This estimation, derived

from actual data, could then be used as a check upon the empirically derived prediction of total phosphorus.

Model validation using observed fall and winter values was achieved by first calculating the means of observed fall and winter concentrations for each lake. An acceptable range was drawn from the defined intent of the sampling program to provide an estimation with a mean standard error of less than 10% of the mean. This intent effectively permitted a  $\pm 20\%$  range (i.e.  $2 \sigma$ ) about the observed mean value. Predicted total phosphorus values within  $\pm 20\%$  of the observed mean value therefore indicated validation of the budget.

## 2.6 Trophic Status

An understanding of aquatic systems can often be enhanced by application of broadly descriptive terms. One of the more scientifically useful terms pertains to the trophic status, or degree of enrichment and productivity\* of a particular waterbody. Three terms are generally used. Oligotrophic refers to unenriched waters of low productivity, mesotrophic refers to moderately enriched waters with moderate productivity and eutrophic refers to very enriched waters which are very productive. Fish kills and excessive aquatic vegetation and algae problems are experienced occasionally in

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\* Within the present report, enrichment refers to nutrient availability and productivity refers to biological mass produced.

mesotrophic waters. Fish kills become more common and problem growths of vegetation and algae become ever more extensive as waters become more eutrophic. Clearly defined limits of demarcation between the trophic levels generally are not encountered. Rather, the characteristics of each gradually meld with that of the next level (Vollenweider, 1968).

A variety of definitive indices or classification schemes have been proposed; four of which have gained general acceptance in North America (Rast and Lee, 1978). Two of the indices, (US EPA, 1974; Piwoni and Lee 1975), are relatively intensive and involve a number of parameters not measured during the present study. Hence, they were not applicable to the present study. The indices of Vollenweider (1975) and Carlson (1977) were more readily applicable to the present study.

Carlson (1977) developed a numerical trophic state index graduated on a scale of 0 to 100. The index number may be calculated from Secchi disk transparency, chlorophyll a or total phosphorus (Ibid). The approximate limit of demarcation between eutrophic and mesotrophic states occurs at 50 units and between mesotrophic and oligotrophic states occurs at approximately 30 units (Ibid). The computational forms of the equation (Ibid) are:

$$\text{Eq. 3. } \text{TSI (SD)}^* = 10 \left( 6 - \frac{\ln \text{SD}}{\ln 2} \right) ;$$

$$\text{Eq. 4. } \text{TSI (Chl)}^* = 10 \left( 6 - \frac{2.04 - 0.68 (\ln \text{Chl})}{\ln 2} \right)$$

$$\text{Eq. 5. } \text{TSI (TP)}^* = 10 \left( 6 - \frac{\ln \text{(TP)}}{\ln 2} \right)$$

Vollenweider's (1975) scale (Figure 2) considered a logarithmic relationship between phosphorus loading and mean depth/hydraulic residence time. The process involves plotting phosphorus loading ( $\text{g/m}^2/\text{yr}$ ) versus mean depth/hydraulic residence time (qS from Table 1). Phosphorus loadings are estimated by the phosphorus budget calculation process (Table 1).

## 2.7 Cottage Capacity Calculation

The cottage equivalent capacity calculation process has been modified from Hough, Stansbury and Michalski Limited (1980). The process is essentially an extension of the phosphorus budget calculation and, has been itemized and discussed in a step by step fashion (Table 2). Phosphorus budget validation is a prerequisite to use of the calculation process.

### Steps 1, 2, 3, 4, 5 & 6:

These values have been extracted from Table 1, steps 18, 19, 26, 32, 25 and 23, respectively.

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\* Where SD is expressed in metres, Chla is expressed in  $\text{mg/m}^3$  and TP is expressed in  $\text{mg/m}^3$ .

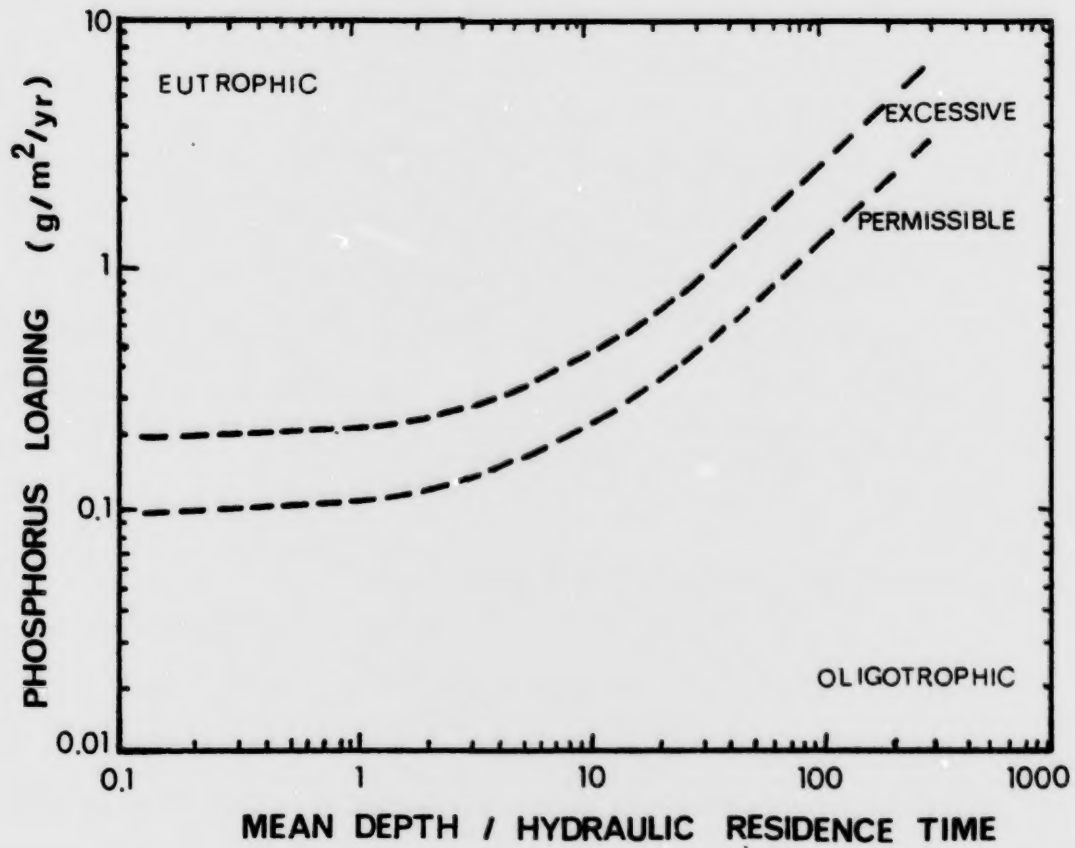


Figure 2: Vollemweider's (1975) trophic state scale.

TABLE 2: CALCULATION PROCESS FOR ESTIMATION OF SOUTH RIDING MOUNTAIN PLANNING DISTRICT LAKES  
COTTAGE EQUIVALENT\* CAPACITY

| <u>STEP</u> | <u>PARAMETER</u>                                                                              | <u>QUANTITATION</u>               |
|-------------|-----------------------------------------------------------------------------------------------|-----------------------------------|
| 1.          | P Contribution per capita (S)                                                                 | $8.0 \times 10^5$ mg/yr.          |
| 2.          | Sewage Treatment Retention Coefficient ( $R_s$ )                                              | 0.63                              |
| 3.          | Capita Years per Cottage ( $P_C$ )                                                            | 0.63 capita years                 |
| 4.          | Total P supply ( $J_T$ )                                                                      | $\times 10$ mg/yr.                |
| 5.          | Number of Cottages ( $N_C$ )                                                                  | units                             |
| 6.          | Campground Capita Years ( $N_{CY}'$ )                                                         | capita years                      |
| 7.          | Total Campground and Cottage Capita Years ( $N_{CY}^2 = P_C \cdot N_C + N_{CY}'$ )            | capita years                      |
| 8.          | P Contributions from Cottages and Campgrounds ( $J_{C1} = N_{CY}^2 \cdot S \cdot [1 - R_s]$ ) | $\times 10$ mg/yr                 |
| 9.          | Significance of Non $-J_{C1}$ Contributions ( $K = [J_T - J_{C1}] / J_T$ )                    |                                   |
| 10.         | Predicted P (P)                                                                               | mg/L                              |
| 11.         | Predicted P minus $J_{C1}$ Contributions ( $P_1 = P \cdot K$ )                                | mg/L                              |
| 12.         | Analytical Error Associated with $P_1$ ( $E_1$ )                                              | mg/L                              |
| 13.         | Calculation Error Permitted ( $E = [E_1 / 4]$ )                                               | mg/L                              |
| 14.         | Outflow (Q)                                                                                   | $\times 10^3$ m <sup>3</sup> /yr. |
| 15.         | Retention Coefficient (R)                                                                     |                                   |
| 16.         | Permissible Cottage and Campground Loading ( $J_{CP} = E \cdot Q / [1 - R]$ )                 | $\times 10$ mg/yr.                |
| 17.         | Permissible Number of Cottage Equivalents ( $N_{CE} = J_{CP} / [1 - R_s] \cdot P_C \cdot S$ ) | units                             |

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\* The term "cottage equivalent" implies that alternate uses can be readily accommodated within the calculation process by application of appropriate conversion factors. For example, one cottage is equivalent to either 0.147 permanent residences, or to 4.5 campsites.

Steps 7 & 8:

These calculations are standard load estimation procedures (Hough, Stansbury and Michalski Limited, 1980).

Step 9:

This ratio quantifies the relative importance of phosphorus contributions other than those from cottage and campground sources.

Step 10:

This value has been extracted from Table 1, step 33.

Step 11:

The calculation provides an estimate of conditions which might have been extant had recreational development not occurred.

Step 12:

Study objectives required that detectable water quality degradation not occur as a result of future developments. Because water quality was defined in the present study by varied terms which were dependent upon total phosphorus concentrations, non detectable water quality degradation was linked to the analytical error associated with measurement of total phosphorus concentrations. Values cited were derived from the precision and accuracy data of Sorba et al (1980).

Step 13:

A safety margin of 50% ( $E_1/2$ ) was considered adequate for present study purposes. Note, however, that as 95% confidence limits may be approximated by  $2\sigma$ , the permissible calculation error is properly quantified at  $[E_1/2]/2$ , or  $[E_1/4]$ .

Steps 14 & 15:

These values have been extracted from Table 1, steps 9 and 12, respectively.

Steps 16 & 17:

These formulae have been modified from Hough, Stansbury and Michalski Limited (1980). Units for Step 17 are rounded off to the nearest whole number.

2.8 Boat Capacity Calculation

Boat capacity calculations or crowding criteria were adopted from Thomas (1983). Boat capacity may be calculated by dividing lake surface area suitable for boating, by the area of water required by each boat for safe and enjoyable operation (Ibid). The present study defined lake surface area suitable for boating as all lake area beyond the 1.5 metre depth contour. Values were obtained during planimetry for lake volume calculations. Thomas' (Ibid) value of average space required per boat (5.28 ha) was directly adopted. Calculated boat capacities were then compared to estimates of maximum current use.

These estimates were computed from the following equation (Ibid):

$$\text{Eq. 6: } B = (N_p \times Q_p) + (N_c \times b \times Q_c)^*$$

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\* Where  $B$  = maximum number of boats on the lake at any one time;

$N_p$  = number of parking spaces available to the public,  
equivalent to Table 1, step 20 "U"

$Q_p$  = number of boats per public parking space; Thomas (Ibid)  
suggests 0.4;

$N_c$  = number of cottages and residences;

$b$  = number of boats per cottage, the present study adopts  
the number "1";

$Q_c$  = number of cottages with a boat in use at any one time;  
Thomas (Ibid) suggests 10%-25% and a median figure  
(17.5%) is adopted in this study.

### 3.0 RESULTS AND DISCUSSION

Water physicochemical data are detailed in Appendix IV.

#### 3.1 The Problem Nutrient

The results of mass ratio calculations are presented in Table 3. The comparatively high values obtained suggested that the theoretical maximum ratios (the theoretical mass ratio (TMR) and the potentially available mass ratio (PAMR)) provided a misleading indication of actual nutrient availability. Such ratios might better be applied to data obtained during winter months or during other periods when biological assimilation of nutrients would be at a minimum. It was felt that the calculated mass ratios (CMR) provided a more accurate estimate of relative nutrient availability. This was because, even though the orthophosphate (available phosphorus) fraction was estimated, the available nitrogen species (ammonia, nitrate and nitrite) were actually measured. Therefore, with respect to the present study, emphasis was placed on the CMR results.

As previously discussed, N:P mass ratios greater than the 7.24 to 10.86 range indicated that phosphorus was the limiting nutrient while N:P mass ratios less than the 7.24 and 10.86 range indicated that nitrogen was the limiting nutrient. The CMR results permitted lakes of the present study to be arranged into three groups; those above the range, those within the range and those below the range. These groups corresponded to phosphorus limited lakes, lakes limited by either phosphorus or nitrogen, and lakes limited by nitrogen, respectively (Table 4).

Table 3. Nitrogen/Phosphorus Mass Ratios\* as an Indication of the Problem Nutrients.

| LAKE                  | RATIOS** |        |       |
|-----------------------|----------|--------|-------|
|                       | TMR      | PAMR   | CMR   |
| Ditch (Gertrude)      | 29.31    | 68.4   | 17.81 |
| Kerr                  | 29.97    | 69.92  | 11.50 |
| Otter                 | 25.95    | 60.50  | 7.53  |
| Little Jackfish       | 13.76    | 32.11  | 1.94  |
| Sandy                 | 66.67    | 155.52 | 16.21 |
| Crawford (St. Dalmas) | 59.49    | 138.80 | 8.50  |
| Thomas                | 71.54    | 166.90 | 8.33  |
| Czornyj (Horod)       | 71.17    | 166.10 | 18.40 |
| Dummy (Blue)          | 71.47    | 166.76 | 8.63  |
| Imrie                 | 83.20    | 194.20 | 48.91 |
| Seech                 | 41.08    | 95.85  | 9.20  |
| Stewart               | 44.32    | 103.40 | 9.52  |

\* Calculated from water quality data obtained during July and August, 1985.

\*\* Where TMR = Theoretical Mass Ratio  
= (Total Kjeldhal Nitrogen)/(Total Phosphorus)

PAMR = Potentially Available Mass Ratio  
= (Total Kjeldhal Nitrogen x 0.7)/(Total Phosphorus x 0.3)

CMR = Calculated Mass Ratio  
= (Ammonia + Nitrite + Nitrate)/Total Phosphorus x 0.1)

**Table 4: Lakes of the South Riding Mountain Planning District  
Grouped on the Basis of Nutrient Sensitivity.**

| LAKES SENSITIVE TO<br>PHOSPHORUS<br>(Phosphorus Limited) | LAKES SENSITIVE TO<br>PHOSPHORUS AND/OR NITROGEN<br>(Balanced Lakes) | LAKES SENSITIVE TO<br>NITROGEN<br>(Nitrogen Limited) |
|----------------------------------------------------------|----------------------------------------------------------------------|------------------------------------------------------|
| Imrie                                                    | Stewart                                                              | Little Jackfish                                      |
| Czornyj (Horod)                                          | Seech                                                                |                                                      |
| Ditch (Gertrude)                                         | Dummy (Blue)                                                         |                                                      |
| Sandy                                                    | Crawford (St. Dalmas)                                                |                                                      |
| Kerr                                                     | Thomas                                                               |                                                      |
|                                                          | Otter                                                                |                                                      |

Placement of each lake in the appropriate group was critical for development of an effective management strategy for each lake. For example, the phosphorus limited lakes (Imrie, Czornyj, Ditch, Sandy and Kerr) would demonstrate little ecological change with substantial additional loadings of nitrogen. However, even minor additional loadings of phosphorus could effect major ecological changes in this group of lakes. Alternately, lakes limited by nitrogen (Little Jackfish) would demonstrate little impact from phosphorus loadings but would show major changes with additional loadings of nitrogen. Relatively balanced lakes (Stewart, Seech, Dummy, Crawford, Thomas and Otter) limited by either phosphorus or nitrogen might be sensitive to loadings of either.

### 3.2 Phosphorus Budgets and Validation

Phosphorus budgets were calculated for each lake (Tables 5-16). Predicted spring total phosphorus concentrations ranged from 0.030 mg/L for Stewart Lake (Table 16) to 0.013 mg/L for Sandy Lake (Table 9).

The suitability of using mean chlorophyll a concentrations for theoretical assessment of the validity of the phosphorus budgets was examined (Table 17). Chlorophyll a production, as indicated by the TSI-chl index, appeared neither significantly inhibited nor enhanced on nine lakes when compared to the TSI-P and TSI-SD indices. It was concluded that chlorophyll a concentrations were suitable for theoretically evaluating the phosphorus budgets of Ditch, Kerr, Otter,

TABLE 5: CALCULATION PROCESS FOR THE DITCH (GERTRUDE) LAKE PHOSPHORUS BUDGET.

| STEP | PARAMETER                                                                  | QUANTITATION                              |
|------|----------------------------------------------------------------------------|-------------------------------------------|
| 1.   | Gross Drainage Basin (A)                                                   | $8.988 \times 10^6 \text{ m}^2$           |
| 2.   | Lake Surface Area (Ao)                                                     | $1.004 \times 10^6 \text{ m}^2$           |
| 3.   | Surface Area of Other Lakes in A ( $Ao_1$ )                                | $0 \times 10^6 \text{ m}^2$               |
| 4.   | Drainage Basin ( $Ad = A - [Ao + Ao_1]$ )                                  | $7.984 \times 10^6 \text{ m}^2$           |
| 5.   | Lake Volume (V)                                                            | $3.673 \times 10^6 \text{ m}^3$           |
| 6.   | Lake Mean Depth ( $Z = V/Ao$ )                                             | 3.66 m                                    |
| 7.   | Net Annual Runoff (r)                                                      | 0.051 m/yr                                |
| 8.   | Net Annual Evaporation ( $E_v$ )                                           | -0.130 m/yr                               |
| 9.   | Outflow $Q = [Ad \cdot r] + E_v \cdot [Ao + Ao_1]$                         | $2.767 \times 10^5 \text{ m}^3/\text{yr}$ |
| 10.  | Flushing Rate ( $p = Q/V$ )                                                | 0.075 times/yr                            |
| 11.  | Areal Water Load ( $qs = Q/Ao$ )                                           | 0.276 m/yr                                |
| 12.  | Retention Coefficient ( $R = 13.2/13.2 + qs$ )                             | 0.980                                     |
| 13.  | P Loading Rate for Precipitation ( $L_{Pr}$ )                              | $41 \text{ mg/m}^2/\text{yr}$             |
| 14.  | P Contribution from Precipitation ( $J_{Pr} = L_{Pr} \cdot Ao$ )           | $4.116 \times 10^7 \text{ mg/yr}$         |
| 15.  | P Export Coefficient (E)                                                   | $23.3 \text{ mg/m}^2/\text{yr}$           |
| 16.  | P Contribution from Drainage Basin ( $J_D = E \cdot Ad$ )                  | $1.860 \times 10^8 \text{ mg/yr}$         |
| 17.  | Total P from Natural Sources ( $J_N = J_{Pr} + J_D$ )                      | $2.272 \times 10^8 \text{ mg/yr}$         |
| 18.  | P Contribution per Capita Year (S)                                         | $8.0 \times 10^5 \text{ mg/yr}$           |
| 19.  | Sewage Treatment Retention Coefficient ( $R_S$ )                           | 0.63                                      |
| 20.  | Total Campground Site Units (U)                                            | 30 units                                  |
| 21.  | Mean Persons per Unit (P)                                                  | 1.51 persons/unit                         |
| 22.  | Mean Season Length (SL)                                                    | 85 days                                   |
| 23.  | Campground Capita Years ( $N_{CY}' = [U \cdot P \cdot SL]/365$ )           | 10.55 capita years                        |
| 24.  | P Contribution from Campground ( $J_A' = S \cdot N_{CY}' [1 - R_S]$ )      | $3.122 \times 10^6 \text{ mg/yr}$         |
| 25.  | Number of Cottages ( $N_C$ )                                               | 129 units*                                |
| 26.  | Capita Years per Cottage ( $P_C$ )                                         | 0.63 capita years                         |
| 27.  | Number of Residences ( $N_D$ )                                             | 3 units                                   |
| 28.  | Capita Years per Residence ( $P_D$ )                                       | 4.3 capita years                          |
| 29.  | Total Occupant Capita Years ( $N_{CY}'' = P_C \cdot N_C + P_D \cdot N_D$ ) | 94.17 capita years                        |
| 30.  | P Contribution from Occupants ( $J_A'' = S \cdot N_{CY}'' [1 - R_S]$ )     | $2.787 \times 10^7 \text{ mg/yr}$         |
| 31.  | Total P from Artificial Sources ( $J_A = J_A' + J_A''$ )                   | $3.100 \times 10^7 \text{ mg/yr}$         |
| 32.  | Total P Supply ( $J_T = J_N + J_A$ )                                       | $2.582 \times 10^8 \text{ mg/yr}$         |
| 33.  | Predicted Spring Total P Concentration ( $P = [J_T(1-R)]/Q$ )              | 0.019 mg/L                                |

\*25 of 154 cottage possess holding tanks and are therefore excluded from the calculations.

TABLE 6: CALCULATION PROCESS FOR THE KERR LAKE PHOSPHORUS BUDGET.

| STEP | PARAMETER                                                                                                            | QUANTITATION                              |
|------|----------------------------------------------------------------------------------------------------------------------|-------------------------------------------|
| 1.   | Gross Drainage Basin (A)                                                                                             | $1.538 \times 10^7 \text{ m}^2$           |
| 2.   | Lake Surface Area (A <sub>o</sub> )                                                                                  | $1.496 \times 10^6 \text{ m}^2$           |
| 3.   | Surface Area of Other Lakes in A (A <sub>o1</sub> )                                                                  | $2.50 \times 10^5 \text{ m}^2$            |
| 4.   | Drainage Basin (A <sub>d</sub> = A - [A <sub>o</sub> + A <sub>o1</sub> ])                                            | $1.363 \times 10^7 \text{ m}^2$           |
| 5.   | Lake Volume (V)                                                                                                      | $3.607 \times 10^6 \text{ m}^3$           |
| 6.   | Lake Mean Depth (Z = V/A <sub>o</sub> )                                                                              | 2.41 m                                    |
| 7.   | Net Annual Runoff (r)                                                                                                | 0.051 m/yr                                |
| 8.   | Net Annual Evaporation (E <sub>v</sub> )                                                                             | -0.130 m/yr                               |
| 9.   | Outflow Q = [A <sub>d</sub> · r] + E <sub>v</sub> · [A <sub>o</sub> + A <sub>o1</sub> ]                              | $4.682 \times 10^5 \text{ m}^3/\text{yr}$ |
| 10.  | Flushing Rate (p = Q/V)                                                                                              | 0.130 times/yr                            |
| 11.  | Areal Water Load (q <sub>s</sub> = Q/A <sub>o</sub> )                                                                | 0.313 m/yr                                |
| 12.  | Retention Coefficient (R = 13.2/13.2 + q <sub>s</sub> )                                                              | 0.977                                     |
| 13.  | P Loading Rate for Precipitation (L <sub>pr</sub> )                                                                  | 41 mg/m <sup>2</sup> /yr                  |
| 14.  | P Contribution from Precipitation (J <sub>pr</sub> = L <sub>pr</sub> · A <sub>o</sub> )                              | $6.134 \times 10^7 \text{ mg/yr}$         |
| 15.  | P Export Coefficient (E)                                                                                             | 23.3 mg/m <sup>2</sup> /yr                |
| 16.  | P Contribution from Drainage Basin (J <sub>D</sub> = E · A <sub>d</sub> )                                            | $3.176 \times 10^8 \text{ mg/yr}$         |
| 17.  | Total P from Natural Sources (J <sub>N</sub> = J <sub>pr</sub> + J <sub>D</sub> )                                    | $3.789 \times 10^8 \text{ mg/yr}$         |
| 18.  | P Contribution per Capita Year (S)                                                                                   | $8.0 \times 10^5 \text{ mg/yr}$           |
| 19.  | Sewage Treatment Retention Coefficient (R <sub>s</sub> )                                                             | 0.63                                      |
| 20.  | Total Campground Site Units (U)                                                                                      | 25 units                                  |
| 21.  | Mean Persons per Unit (P)                                                                                            | 1.51 persons/unit                         |
| 22.  | Mean Season Length (SL)                                                                                              | 85 days                                   |
| 23.  | Campground Capita Years (N <sub>CY</sub> ' = [U · P · SL]/365)                                                       | 8.79 capita years                         |
| 24.  | P Contribution from Campground (J <sub>A</sub> ' = S · N <sub>CY</sub> ' [1 - R <sub>s</sub> ])                      | $2.602 \times 10^6 \text{ mg/yr}$         |
| 25.  | Number of Cottages (N <sub>C</sub> )                                                                                 | 12 units*                                 |
| 26.  | Capita Years per Cottage (P <sub>C</sub> )                                                                           | 0.63 capita years                         |
| 27.  | Number of Residences (N <sub>D</sub> )                                                                               | 1 unit                                    |
| 28.  | Capita Years per Residence (P <sub>D</sub> )                                                                         | 4.3 capita years                          |
| 29.  | Total Occupant Capita Years (N <sub>CY</sub> " = P <sub>C</sub> · N <sub>C</sub> + P <sub>D</sub> · N <sub>D</sub> ) | 11.86 capita years                        |
| 30.  | P Contribution from Occupants (J <sub>A</sub> " = S · N <sub>CY</sub> " [1 - R <sub>s</sub> ])                       | $3.511 \times 10^6 \text{ mg/yr}$         |
| 31.  | Total P from Artificial Sources (J <sub>A</sub> = J <sub>A</sub> ' + J <sub>A</sub> " )                              | $6.113 \times 10^6 \text{ mg/yr}$         |
| 32.  | Total P Supply (J <sub>T</sub> = J <sub>N</sub> + J <sub>A</sub> )                                                   | $3.850 \times 10^8 \text{ mg/yr}$         |
| 33.  | Predicted Spring Total P Concentration (P = [J <sub>T</sub> (1-R)]/Q)                                                | 0.019 mg/L                                |

\* 4 of 16 cottages possess holding tanks and are therefore excluded from the calculations.

TABLE 7: CALCULATION PROCESS FOR THE OTTER LAKE PHOSPHORUS BUDGET.

| STEP | PARAMETER                                                                                                          | QUANTITATION                              |
|------|--------------------------------------------------------------------------------------------------------------------|-------------------------------------------|
| 1.   | Gross Drainage Basin (A)                                                                                           | $1.481 \times 10^8 \text{ m}^2$           |
| 2.   | Lake Surface Area (Ao)                                                                                             | $1.016 \times 10^7 \text{ m}^2$           |
| 3.   | Surface Area of Other Lakes in A (Ao <sub>1</sub> )                                                                | $4.25 \times 10^6 \text{ m}^2$            |
| 4.   | Drainage Basin (Ad = A - [Ao + Ao <sub>1</sub> ])                                                                  | $1.337 \times 10^8 \text{ m}^2$           |
| 5.   | Lake Volume (V)                                                                                                    | $1.397 \times 10^7 \text{ m}^3$           |
| 6.   | Lake Mean Depth (Z = V/Ao)                                                                                         | 1.38 m                                    |
| 7.   | Net Annual Runoff (r)                                                                                              | 0.051 m/yr                                |
| 8.   | Net Annual Evaporation (E <sub>v</sub> )                                                                           | -0.130 m/yr                               |
| 9.   | Outflow Q = [Ad·r] + E <sub>v</sub> ·[Ao + Ao <sub>1</sub> ]                                                       | $4.945 \times 10^6 \text{ m}^3/\text{yr}$ |
| 10.  | Flushing Rate (p = Q/V)                                                                                            | 0.354 times/yr                            |
| 11.  | Areal Water Load (qs = Q/Ao)                                                                                       | 0.487 m/yr                                |
| 12.  | Retention Coefficient (R = 13.2/13.2 + qs)                                                                         | 0.964                                     |
| 13.  | P Loading Rate for Precipitation (L <sub>Pr</sub> )                                                                | $41 \text{ mg/m}^2/\text{yr}$             |
| 14.  | P Contribution from Precipitation (J <sub>Pr</sub> = L <sub>Pr</sub> ·Ao)                                          | $4.166 \times 10^8 \text{ mg/yr}$         |
| 15.  | P Export Coefficient (E)                                                                                           | $23.3 \text{ mg/m}^2/\text{yr}$           |
| 16.  | P Contribution from Drainage Basin (J <sub>D</sub> = E·Ad)                                                         | $3.115 \times 10^9 \text{ mg/yr}$         |
| 17.  | Total P from Natural Sources (J <sub>N</sub> = J <sub>Pr</sub> + J <sub>D</sub> )                                  | $3.532 \times 10^9 \text{ mg/yr}$         |
| 18.  | P Contribution per Capita Year (S)                                                                                 | $8.0 \times 10^5 \text{ mg/yr}$           |
| 19.  | Sewage Treatment Retention Coefficient (R <sub>S</sub> )                                                           | 0.63                                      |
| 20.  | Total Campground Site Units (U)                                                                                    | 30 units                                  |
| 21.  | Mean Persons per Unit (P)                                                                                          | 1.51 persons/unit                         |
| 22.  | Mean Season Length (SL)                                                                                            | 85 days                                   |
| 23.  | Campground Capita Years (N <sub>CY</sub> ' = [U·P·SL]/365)                                                         | 10.55 capita years                        |
| 24.  | P Contribution from Campground (J <sub>A</sub> ' = S·N <sub>CY</sub> '[1 - R <sub>S</sub> ])                       | $3.122 \times 10^6 \text{ mg/yr}$         |
| 25.  | Number of Cottages (N <sub>C</sub> )                                                                               | 127 units                                 |
| 26.  | Capita Years per Cottage (P <sub>C</sub> )                                                                         | 0.63 capita years                         |
| 27.  | Number of Residences (N <sub>D</sub> )                                                                             | 6 units                                   |
| 28.  | Capita Years per Residence (P <sub>D</sub> )                                                                       | 4.3 capita years                          |
| 29.  | Total Occupant Capita Years (N <sub>CY</sub> " = P <sub>C</sub> ·N <sub>C</sub> + P <sub>D</sub> ·N <sub>D</sub> ) | 105.81 capita years                       |
| 30.  | P Contribution from Occupants (J <sub>A</sub> " = S·N <sub>CY</sub> "[1 - R <sub>S</sub> ])                        | $3.132 \times 10^7 \text{ mg/yr}$         |
| 31.  | Total P from Artificial Sources (J <sub>A</sub> = J <sub>A</sub> ' + J <sub>A</sub> " )                            | $3.444 \times 10^7 \text{ mg/yr}$         |
| 32.  | Total P Supply (J <sub>T</sub> = J <sub>N</sub> + J <sub>A</sub> )                                                 | $3.566 \times 10^9 \text{ mg/yr}$         |
| 33.  | Predicted Spring Total P Concentration (P = [J <sub>T</sub> (1 - R)]/Q)                                            | 0.026 mg/L                                |

TABLE 3: CALCULATION PROCESS FOR THE LITTLE JACKFISH LAKE PHOSPHORUS BUDGET.\*

| STEP | PARAMETER                                                                  | QUANTITATION                              |
|------|----------------------------------------------------------------------------|-------------------------------------------|
| 1.   | Gross Drainage Basin (A)                                                   | $6.595 \times 10^6 \text{ m}^2$           |
| 2.   | Lake Surface Area (Ao)                                                     | $7.857 \times 10^5 \text{ m}^2$           |
| 3.   | Surface Area of Other Lakes in A ( $Ao_1$ )                                | $4.520 \times 10^5 \text{ m}^2$           |
| 4.   | Drainage Basin ( $Ad = A - [Ao + Ao_1]$ )                                  | $5.357 \times 10^6 \text{ m}^2$           |
| 5.   | Lake Volume (V)                                                            | $2.053 \times 10^6 \text{ m}^3$           |
| 6.   | Lake Mean Depth ( $Z = V/Ao$ )                                             | 2.61 m                                    |
| 7.   | Net Annual Runoff (r)                                                      | 0.051 m/yr                                |
| 8.   | Net Annual Evaporation ( $E_v$ )                                           | -0.130 m/yr                               |
| 9.   | Outflow $Q = [Ad \cdot r] + E_v \cdot [Ao + Ao_1]$                         | $1.123 \times 10^5 \text{ m}^3/\text{yr}$ |
| 10.  | Flushing Rate ( $p = Q/V$ )                                                | 0.055 times/yr                            |
| 11.  | Areal Water Load ( $qs = Q/Ao$ )                                           | 0.143 m/yr                                |
| 12.  | Retention Coefficient ( $R = 13.2/13.2 + qs$ )                             | 0.989                                     |
| 13.  | P Loading Rate for Precipitation ( $L_{Pr}$ )                              | $41 \text{ mg/m}^2/\text{yr}$             |
| 14.  | P Contribution from Precipitation ( $J_{Pr} = L_{Pr} \cdot Ao$ )           | $3.221 \times 10^7 \text{ mg/yr}$         |
| 15.  | P Export Coefficient (E)                                                   | $23.3 \text{ mg/m}^2/\text{yr}$           |
| 16.  | P Contribution from Drainage Basin ( $J_D = E \cdot Ad$ )                  | $1.248 \times 10^8 \text{ mg/yr}$         |
| 17.  | Total P from Natural Sources ( $J_N = J_{Pr} + J_D$ )                      | $1.570 \times 10^8 \text{ mg/yr}$         |
| 18.  | P Contribution per Capita Year (S)                                         | $8.0 \times 10^5 \text{ mg/yr}$           |
| 19.  | Sewage Treatment Retention Coefficient ( $R_S$ )                           | 0.63                                      |
| 20.  | Total Campground Site Units (U)                                            | 2 units                                   |
| 21.  | Mean Persons per Unit (P)                                                  | 1.51 persons/unit                         |
| 22.  | Mean Season Length (SL)                                                    | 85 days                                   |
| 23.  | Campground Capita Years ( $N_{CY}' = [U \cdot P \cdot SL]/365$ )           | 0.70 capita years                         |
| 24.  | P Contribution from Campground ( $J_A' = S \cdot N_{CY}' [1 - R_S]$ )      | $2.07 \times 10^5 \text{ mg/yr}$          |
| 25.  | Number of Cottages ( $N_C$ )                                               | 0 units                                   |
| 26.  | Capita Years per Cottage ( $P_C$ )                                         | 0.63 capita years                         |
| 27.  | Number of Residences ( $N_D$ )                                             | 3 units                                   |
| 28.  | Capita Years per Residence ( $P_D$ )                                       | 4.3 capita years                          |
| 29.  | Total Occupant Capita Years ( $N_{CY}'' = P_C \cdot N_C + P_D \cdot N_D$ ) | 12.9 capita years                         |
| 30.  | P Contribution from Occupants ( $J_A'' = S \cdot N_{CY}'' [1 - R_S]$ )     | $3.818 \times 10^6 \text{ mg/yr}$         |
| 31.  | Total P from Artificial Sources ( $J_A = J_A' + J_A''$ )                   | $4.025 \times 10^6 \text{ mg/yr}$         |
| 32.  | Total P Supply ( $J_T = J_N + J_A$ )                                       | $1.610 \times 10^8 \text{ mg/yr}$         |
| 33.  | Predicted Spring Total P Concentration ( $P = [J_T(1-R)]/Q$ )              | 0.016 mg/L                                |

\* Although not limited by phosphorus (Sec. 3.1), the calculation process has been completed for the sake of data consistency.

TABLE 9: CALCULATION PROCESS FOR THE SANDY LAKE PHOSPHORUS BUDGET.\*

| STEP | PARAMETER                                                                                                          | QUANTITATION                              |
|------|--------------------------------------------------------------------------------------------------------------------|-------------------------------------------|
| 1.   | Gross Drainage Basin (A)                                                                                           | $3.368 \times 10^7 \text{ m}^2$           |
| 2.   | Lake Surface Area (Ao)                                                                                             | $4.840 \times 10^6 \text{ m}^2$ *         |
| 3.   | Surface Area of Other Lakes in A (Ao <sub>1</sub> )                                                                | $2.130 \times 10^6 \text{ m}^2$           |
| 4.   | Drainage Basin (Ad = A-[Ao+Ao <sub>1</sub> ])                                                                      | $2.671 \times 10^7 \text{ m}^2$           |
| 5.   | Lake Volume (V)                                                                                                    | $1.918 \times 10^7 \text{ m}^3$           |
| 6.   | Lake Mean Depth (Z = V/Ao)                                                                                         | 3.23 m                                    |
| 7.   | Net Annual Runoff (r)                                                                                              | 0.051 m/yr                                |
| 8.   | Net Annual Evaporation (E <sub>v</sub> )                                                                           | -0.130 m/yr                               |
| 9.   | Outflow Q = [Ad·r]+E <sub>v</sub> ·[Ao+Ao <sub>1</sub> ]                                                           | $4.561 \times 10^5 \text{ m}^3/\text{yr}$ |
| 10.  | Flushing Rate (p = Q/V)                                                                                            | 0.024 times/yr                            |
| 11.  | Areal Water Load (qs = Q/Ao)                                                                                       | 0.094 m/yr                                |
| 12.  | Retention Coefficient (R = 13.2/13.2 +qs)                                                                          | 0.993                                     |
| 13.  | P Loading Rate for Precipitation (L <sub>Pr</sub> )                                                                | 41 mg/m <sup>2</sup> /yr                  |
| 14.  | P Contribution from Precipitation (J <sub>Pr</sub> = L <sub>Pr</sub> ·Ao)                                          | $1.984 \times 10^8 \text{ mg/yr}$         |
| 15.  | P Export Coefficient (E)                                                                                           | 23.3 mg/m <sup>2</sup> /yr                |
| 16.  | P Contribution from Drainage Basin (J <sub>D</sub> = E·Ad)                                                         | $6.223 \times 10^8 \text{ mg/yr}$         |
| 17.  | Total P from Natural Sources (J <sub>N</sub> = J <sub>Pr</sub> + J <sub>D</sub> )                                  | $8.207 \times 10^8 \text{ mg/yr}$         |
| 18.  | P Contribution per Capita Year (S)                                                                                 | $8.0 \times 10^5 \text{ mg/yr.}$          |
| 19.  | Sewage Treatment Retention Coefficient (R <sub>S</sub> )                                                           | 0.63                                      |
| 20.  | Total Campground Site Units (U)                                                                                    | 5 units                                   |
| 21.  | Mean Persons per Unit (P)                                                                                          | 1.51 persons/unit                         |
| 22.  | Mean Season Length (SL)                                                                                            | 85 days                                   |
| 23.  | Campground Capita Years (N <sub>CY</sub> ' = [U·P·SL]/365)                                                         | 1.76 capita years                         |
| 24.  | P Contribution from Campground (J <sub>A</sub> ' = S·N <sub>CY</sub> '[1-R <sub>S</sub> ])                         | $5.204 \times 10^5 \text{ mg/yr}$         |
| 25.  | Number of Cottages (N <sub>C</sub> )                                                                               | 231 units**                               |
| 26.  | Capita Years per Cottage (P <sub>C</sub> )                                                                         | 0.63 capita years                         |
| 27.  | Number of Residences (N <sub>D</sub> )                                                                             | 4 units***                                |
| 28.  | Capita Years per Residence (P <sub>D</sub> )                                                                       | 4.3 capita years                          |
| 29.  | Total Occupant Capita Years (N <sub>CY</sub> " = P <sub>C</sub> ·N <sub>C</sub> + P <sub>D</sub> ·N <sub>D</sub> ) | 162.73 capita years                       |
| 30.  | P Contribution from Occupants (J <sub>A</sub> " = S·N <sub>CY</sub> "[1-R <sub>S</sub> ])                          | $4.817 \times 10^7 \text{ mg/yr}$         |
| 31.  | Total P from Artificial Sources (J <sub>A</sub> = J <sub>A</sub> ' + J <sub>A</sub> " )                            | $4.869 \times 10^7 \text{ mg/yr}$         |
| 32.  | Total P Supply (J <sub>T</sub> = J <sub>N</sub> + J <sub>A</sub> )                                                 | $8.694 \times 10^8 \text{ mg/yr}$         |
| 33.  | Predicted Spring Total P Concentration (P = [J <sub>T</sub> (1-R)]/Q)                                              | 0.013 mg/L                                |

\* Only the contiguous south basin is considered.

\*\* 5 of the 236 cottages are equipped with holding tanks and are therefore excluded from the calculation.

\*\*\* Only residences presumed not to be connected to community sewerage are included.

TABLE 10: CALCULATION PROCESS FOR THE CRAWFORD (ST. DALMAS) LAKE PHOSPHORUS BUDGET.

| STEP | PARAMETER                                                                  | QUANTITATION                              |
|------|----------------------------------------------------------------------------|-------------------------------------------|
| 1.   | Gross Drainage Basin (A)                                                   | $1.019 \times 10^7 \text{ m}^2$           |
| 2.   | Lake Surface Area (Ao)                                                     | $6.88 \times 10^5 \text{ m}^2$            |
| 3.   | Surface Area of Other Lakes in A ( $Ao_1$ )                                | $1.168 \times 10^6 \text{ m}^2$           |
| 4.   | Drainage Basin ( $Ad = A - [Ao + Ao_1]$ )                                  | $8.334 \times 10^6 \text{ m}^2$           |
| 5.   | Lake Volume (V)                                                            | $2.953 \times 10^6 \text{ m}^3$           |
| 6.   | Lake Mean Depth ( $Z = V/Ao$ )                                             | 4.29 m                                    |
| 7.   | Net Annual Runoff (r)                                                      | 0.051 m/yr                                |
| 8.   | Net Annual Evaporation ( $E_v$ )                                           | -0.130 m/yr                               |
| 9.   | Outflow $Q = [Ad \cdot r] + E_v \cdot [Ao + Ao_1]$                         | $1.838 \times 10^5 \text{ m}^3/\text{yr}$ |
| 10.  | Flushing Rate ( $p = Q/V$ )                                                | 0.062 times/yr                            |
| 11.  | Areal Water Load ( $qs = Q/Ao$ )                                           | 0.267 m/yr                                |
| 12.  | Retention Coefficient ( $R = 13.2/13.2 + qs$ )                             | 0.980                                     |
| 13.  | P Loading Rate for Precipitation ( $L_{Pr}$ )                              | $41 \text{ mg/m}^2/\text{yr}$             |
| 14.  | P Contribution from Precipitation ( $J_{Pr} = L_{Pr} \cdot Ao$ )           | $2.82 \times 10^7 \text{ mg/yr}$          |
| 15.  | P Export Coefficient (E)                                                   | $23.3 \text{ mg/m}^2/\text{yr}$           |
| 16.  | P Contribution from Drainage Basin ( $J_D = E \cdot Ad$ )                  | $1.942 \times 10^8 \text{ mg/yr}$         |
| 17.  | Total P from Natural Sources ( $J_N = J_{Pr} + J_D$ )                      | $2.224 \times 10^8 \text{ mg/yr}$         |
| 18.  | P Contribution per Capita Year (S)                                         | $8.0 \times 10^5 \text{ mg/yr}$           |
| 19.  | Sewage Treatment Retention Coefficient ( $R_S$ )                           | 0.63                                      |
| 20.  | Total Campground Site Units (U)                                            | 10 units                                  |
| 21.  | Mean Persons per Unit (P)                                                  | 1.51 persons/unit                         |
| 22.  | Mean Season Length (SL)                                                    | 85 days                                   |
| 23.  | Campground Capita Years ( $N_{CY}' = [U \cdot P \cdot SL]/365$ )           | 3.52 capita years                         |
| 24.  | P Contribution from Campground ( $J_A' = S \cdot N_{CY}' [1 - R_S]$ )      | $1.041 \times 10^6 \text{ mg/yr}$         |
| 25.  | Number of Cottages ( $N_C$ )                                               | 4 units                                   |
| 26.  | Capita Years per Cottage ( $P_C$ )                                         | 0.63 capita years                         |
| 27.  | Number of Residences ( $N_D$ )                                             | 1 unit                                    |
| 28.  | Capita Years per Residence ( $P_D$ )                                       | 4.3 capita years                          |
| 29.  | Total Occupant Capita Years ( $N_{CY}'' = P_C \cdot N_C + P_D \cdot N_D$ ) | 6.82 capita years                         |
| 30.  | P Contribution from Occupants ( $J_A'' = S \cdot N_{CY}'' [1 - R_S]$ )     | $2.019 \times 10^6 \text{ mg/yr}$         |
| 31.  | Total P from Artificial Sources ( $J_A = J_A' + J_A''$ )                   | $3.060 \times 10^6 \text{ mg/yr}$         |
| 32.  | Total P Supply ( $J_T = J_N + J_A$ )                                       | $2.255 \times 10^8 \text{ mg/yr}$         |
| 33.  | Predicted Spring Total P Concentration ( $P = [J_T(1-R)]/Q$ )              | 0.025 mg/L                                |

TABLE 11: CALCULATION PROCESS FOR THE THOMAS LAKE PHOSPHORUS BUDGET.

| STEP | PARAMETER                                                                                                          | QUANTITATION                              |
|------|--------------------------------------------------------------------------------------------------------------------|-------------------------------------------|
| 1.   | Gross Drainage Basin (A)                                                                                           | $3.60 \times 10^7 \text{ m}^2$            |
| 2.   | Lake Surface Area (Ao)                                                                                             | $3.065 \times 10^6 \text{ m}^2$           |
| 3.   | Surface Area of Other Lakes in A (Ao <sub>1</sub> )                                                                | $4.854 \times 10^6 \text{ m}^2$           |
| 4.   | Drainage Basin (Ad = A-[Ao+Ao <sub>1</sub> ])                                                                      | $2.808 \times 10^7 \text{ m}^2$           |
| 5.   | Lake Volume (V)                                                                                                    | $1.134 \times 10^7 \text{ m}^3$           |
| 6.   | Lake Mean Depth (Z = V/Ao)                                                                                         | 3.70 m                                    |
| 7.   | Net Annual Runoff (r)                                                                                              | 0.051 m/yr                                |
| 8.   | Net Annual Evaporation (E <sub>v</sub> )                                                                           | -0.130 m/yr                               |
| 9.   | Outflow Q = [Ad·r]+E <sub>v</sub> ·[Ao+Ao <sub>1</sub> ]                                                           | $4.026 \times 10^5 \text{ m}^3/\text{yr}$ |
| 10.  | Flushing Rate (p = Q/V)                                                                                            | 0.036 times/yr                            |
| 11.  | Areal Water Load (qs = Q/Ao)                                                                                       | 0.131 m/yr                                |
| 12.  | Retention Coefficient (R = 13.2/13.2 +qs)                                                                          | 0.990                                     |
| 13.  | P Loading Rate for Precipitation (L <sub>Pr</sub> )                                                                | 41 mg/m <sup>2</sup> /yr                  |
| 14.  | P Contribution from Precipitation (J <sub>Pr</sub> = L <sub>Pr</sub> ·Ao)                                          | $1.257 \times 10^8 \text{ mg/yr}$         |
| 15.  | P Export Coefficient (E)                                                                                           | 23.3 mg/m <sup>2</sup> /yr                |
| 16.  | P Contribution from Drainage Basin (J <sub>D</sub> = E·Ad)                                                         | $6.543 \times 10^8 \text{ mg/yr}$         |
| 17.  | Total P from Natural Sources (J <sub>N</sub> = J <sub>Pr</sub> + J <sub>D</sub> )                                  | $7.800 \times 10^8 \text{ mg/yr}$         |
| 18.  | P Contribution per Capita Year (S)                                                                                 | $8.0 \times 10^5 \text{ mg/yr.}$          |
| 19.  | Sewage Treatment Retention Coefficient (R <sub>S</sub> )                                                           | 0.63                                      |
| 20.  | Total Campground Site Units (U)                                                                                    | 45 units                                  |
| 21.  | Mean Persons per Unit (P)                                                                                          | 1.51 persons/unit                         |
| 22.  | Mean Season Length (SL)                                                                                            | 85 days                                   |
| 23.  | Campground Capita Years (N <sub>CY</sub> ' = [U·P·SL]/365)                                                         | 15.82 capita years                        |
| 24.  | P Contribution from Campground (J <sub>A</sub> ' = S·N <sub>CY</sub> '[1-R <sub>S</sub> ])                         | $4.684 \times 10^6 \text{ mg/yr}$         |
| 25.  | Number of Cottages (N <sub>C</sub> )                                                                               | 65 units*                                 |
| 26.  | Capita Years per Cottage (P <sub>C</sub> )                                                                         | 0.63 capita years                         |
| 27.  | Number of Residences (N <sub>D</sub> )                                                                             | 2 units                                   |
| 28.  | Capita Years per Residence (P <sub>D</sub> )                                                                       | 4.3 capita years                          |
| 29.  | Total Occupant Capita Years (N <sub>CY</sub> " = P <sub>C</sub> ·N <sub>C</sub> + P <sub>D</sub> ·N <sub>D</sub> ) | 49.55 capita years                        |
| 30.  | P Contribution from Occupants (J <sub>A</sub> " = S·N <sub>CY</sub> "[1-R <sub>S</sub> ])                          | $1.467 \times 10^7 \text{ mg/yr}$         |
| 31.  | Total P from Artificial Sources (J <sub>A</sub> = J <sub>A</sub> ' + J <sub>A</sub> " )                            | $1.935 \times 10^7 \text{ mg/yr}$         |
| 32.  | Total P Supply (J <sub>T</sub> = J <sub>N</sub> + J <sub>A</sub> )                                                 | $7.994 \times 10^8 \text{ mg/yr}$         |
| 33.  | Predicted Spring Total P Concentration (P = [J <sub>T</sub> (1-R)]/Q)                                              | 0.020 mg/L                                |

\* 27 of the 92 cottages/seasonal trailer lots are equipped with holding tanks and are therefore excluded from the calculation.

TABLE 12: CALCULATION PROCESS FOR THE CZORNYJ (HOROD) LAKE PHOSPHORUS BUDGET.

| STEP | PARAMETER                                                                  | QUANTITATION                              |
|------|----------------------------------------------------------------------------|-------------------------------------------|
| 1.   | Gross Drainage Basin (A)                                                   | $4.892 \times 10^6 \text{ m}^2$           |
| 2.   | Lake Surface Area (Ao)                                                     | $4.94 \times 10^5 \text{ m}^2$            |
| 3.   | Surface Area of Other Lakes in A ( $Ao_1$ )                                | $4.94 \times 10^5 \text{ m}^2$            |
| 4.   | Drainage Basin ( $Ad = A - [Ao + Ao_1]$ )                                  | $3.904 \times 10^6 \text{ m}^2$           |
| 5.   | Lake Volume (V)                                                            | $1.289 \times 10^6 \text{ m}^3$           |
| 6.   | Lake Mean Depth ( $Z = V/Ao$ )                                             | 2.61 m                                    |
| 7.   | Net Annual Runoff (r)                                                      | 0.051 m/yr                                |
| 8.   | Net Annual Evaporation ( $E_V$ )                                           | -0.130 m/yr                               |
| 9.   | Outflow $Q = [Ad \cdot r] + E_V \cdot [Ao + Ao_1]$                         | $1.211 \times 10^5 \text{ m}^3/\text{yr}$ |
| 10.  | Flushing Rate ( $p = Q/V$ )                                                | 0.094 times/yr                            |
| 11.  | Areal Water Load ( $qs = Q/Ao$ )                                           | 0.245 m/yr                                |
| 12.  | Retention Coefficient ( $R = 13.2/13.2 + qs$ )                             | 0.982                                     |
| 13.  | P Loading Rate for Precipitation ( $L_{Pr}$ )                              | $41 \text{ mg/m}^2/\text{yr}$             |
| 14.  | P Contribution from Precipitation ( $J_{Pr} = L_{Pr} \cdot Ao$ )           | $2.025 \times 10^7 \text{ mg/yr}$         |
| 15.  | P Export Coefficient (E)                                                   | $23.3 \text{ mg/m}^2/\text{yr}$           |
| 16.  | P Contribution from Drainage Basin ( $J_D = E \cdot Ad$ )                  | $9.096 \times 10^7 \text{ mg/yr}$         |
| 17.  | Total P from Natural Sources ( $J_N = J_{Pr} + J_D$ )                      | $1.112 \times 10^8 \text{ mg/yr}$         |
| 18.  | P Contribution per Capita Year (S)                                         | $8.0 \times 10^5 \text{ mg/yr}$           |
| 19.  | Sewage Treatment Retention Coefficient ( $R_S$ )                           | 0.63                                      |
| 20.  | Total Campground Site Units (U)                                            | 5 units                                   |
| 21.  | Mean Persons per Unit (P)                                                  | 1.51 persons/unit                         |
| 22.  | Mean Season Length (SL)                                                    | 85 days                                   |
| 23.  | Campground Capita Years ( $N_{CY}' = [U \cdot P \cdot SL]/365$ )           | 1.76 capita years                         |
| 24.  | P Contribution from Campground ( $J_A' = S \cdot N_{CY}' [1 - R_S]$ )      | $5.21 \times 10^5 \text{ mg/yr}$          |
| 25.  | Number of Cottages ( $N_C$ )                                               | 2 units                                   |
| 26.  | Capita Years per Cottage ( $P_C$ )                                         | 0.63 capita years                         |
| 27.  | Number of Residences ( $N_D$ )                                             | 0 units                                   |
| 28.  | Capita Years per Residence ( $P_D$ )                                       | 4.3 capita years                          |
| 29.  | Total Occupant Capita Years ( $N_{CY}'' = P_C \cdot N_C + P_D \cdot N_D$ ) | 1.26 capita years                         |
| 30.  | P Contribution from Occupants ( $J_A'' = S \cdot N_{CY}'' [1 - R_S]$ )     | $3.73 \times 10^5 \text{ mg/yr}$          |
| 31.  | Total P from Artificial Sources ( $J_A = J_A' + J_A''$ )                   | $8.94 \times 10^5 \text{ mg/yr}$          |
| 32.  | Total P Supply ( $J_T = J_N + J_A$ )                                       | $1.121 \times 10^8 \text{ mg/yr}$         |
| 33.  | Predicted Spring Total P Concentration ( $P = [J_T(1-R)]/Q$ )              | 0.017 mg/L                                |

TABLE 13: CALCULATION PROCESS FOR THE BLUE (DUMMY) LAKE PHOSPHORUS BUDGET.

| STEP | PARAMETER                                                                                                          | QUANTITATION                              |
|------|--------------------------------------------------------------------------------------------------------------------|-------------------------------------------|
| 1.   | Gross Drainage Basin (A)                                                                                           | $1.608 \times 10^7 \text{ m}^2$           |
| 2.   | Lake Surface Area (Ao)                                                                                             | $2.003 \times 10^6 \text{ m}^2$           |
| 3.   | Surface Area of Other Lakes in A (Ao <sub>1</sub> )                                                                | $9.39 \times 10^5 \text{ m}^2$            |
| 4.   | Drainage Basin (Ad = A - [Ao + Ao <sub>1</sub> ])                                                                  | $1.331 \times 10^7 \text{ m}^2$           |
| 5.   | Lake Volume (V)                                                                                                    | $8.996 \times 10^6 \text{ m}^3$           |
| 6.   | Lake Mean Depth (Z = V/Ao)                                                                                         | 4.49 m                                    |
| 7.   | Net Annual Runoff (r)                                                                                              | 0.051 m/yr                                |
| 8.   | Net Annual Evaporation (E <sub>v</sub> )                                                                           | -0.130 m/yr                               |
| 9.   | Outflow Q = [Ad·r] + E <sub>v</sub> ·[Ao + Ao <sub>1</sub> ]                                                       | $2.964 \times 10^5 \text{ m}^3/\text{yr}$ |
| 10.  | Flushing Rate (p = Q/V)                                                                                            | 0.033 times/yr                            |
| 11.  | Areal Water Load (qs = Q/Ao)                                                                                       | 0.148 m/yr                                |
| 12.  | Retention Coefficient (R = 13.2/13.2 + qs)                                                                         | 0.989                                     |
| 13.  | P Loading Rate for Precipitation (L <sub>Pr</sub> )                                                                | 41 mg/m <sup>2</sup> /yr                  |
| 14.  | P Contribution from Precipitation (J <sub>Pr</sub> = L <sub>Pr</sub> ·Ao)                                          | $8.212 \times 10^7 \text{ mg/yr}$         |
| 15.  | P Export Coefficient (E)                                                                                           | 23.3 mg/m <sup>2</sup> /yr                |
| 16.  | P Contribution from Drainage Basin (J <sub>D</sub> = E·Ad)                                                         | $3.101 \times 10^8 \text{ mg/yr}$         |
| 17.  | Total P from Natural Sources (J <sub>N</sub> = J <sub>Pr</sub> + J <sub>D</sub> )                                  | $3.922 \times 10^8 \text{ mg/yr}$         |
| 18.  | P Contribution per Capita Year (S)                                                                                 | $8.0 \times 10^5 \text{ mg/yr}$           |
| 19.  | Sewage Treatment Retention Coefficient (R <sub>S</sub> )                                                           | 0.63                                      |
| 20.  | Total Campground Site Units (U)                                                                                    | 2 units                                   |
| 21.  | Mean Persons per Unit (P)                                                                                          | 1.51 persons/unit                         |
| 22.  | Mean Season Length (SL)                                                                                            | 85 days                                   |
| 23.  | Campground Capita Years (N <sub>CY</sub> ' = [U·P·SL]/365)                                                         | 0.70 capita years                         |
| 24.  | P Contribution from Campground (J <sub>A</sub> ' = S·N <sub>CY</sub> '·[1 - R <sub>S</sub> ])                      | $2.07 \times 10^5 \text{ mg/yr}$          |
| 25.  | Number of Cottages (N <sub>C</sub> )                                                                               | 0 units                                   |
| 26.  | Capita Years per Cottage (P <sub>C</sub> )                                                                         | 0.63 capita years                         |
| 27.  | Number of Residences (N <sub>D</sub> )                                                                             | 0 units                                   |
| 28.  | Capita Years per Residence (P <sub>D</sub> )                                                                       | 4.3 capita years                          |
| 29.  | Total Occupant Capita Years (N <sub>CY</sub> " = P <sub>C</sub> ·N <sub>C</sub> + P <sub>D</sub> ·N <sub>D</sub> ) | 0 capita years                            |
| 30.  | P Contribution from Occupants (J <sub>A</sub> " = S·N <sub>CY</sub> "·[1 - R <sub>S</sub> ])                       | 0 mg/yr                                   |
| 31.  | Total P from Artificial Sources (J <sub>A</sub> = J <sub>A</sub> ' + J <sub>A</sub> " )                            | $2.07 \times 10^5 \text{ mg/yr}$          |
| 32.  | Total P Supply (J <sub>T</sub> = J <sub>N</sub> + J <sub>A</sub> )                                                 | $3.924 \times 10^8 \text{ mg/yr}$         |
| 33.  | Predicted Spring Total P Concentration (P = [J <sub>T</sub> (1-R)]/Q)                                              | 0.015 mg/L                                |

TABLE 14: CALCULATION PROCESS FOR THE IMRIE LAKE PHOSPHORUS BUDGET.

| STEP | PARAMETER                                                                  | QUANTITATION                              |
|------|----------------------------------------------------------------------------|-------------------------------------------|
| 1.   | Gross Drainage Basin (A)                                                   | $8.640 \times 10^6 \text{ m}^2$           |
| 2.   | Lake Surface Area (Ao)                                                     | $1.064 \times 10^6 \text{ m}^2$           |
| 3.   | Surface Area of Other Lakes in A ( $Ao_1$ )                                | $2.66 \times 10^5 \text{ m}^2$            |
| 4.   | Drainage Basin ( $Ad = A - [Ao + Ao_1]$ )                                  | $7.310 \times 10^6 \text{ m}^2$           |
| 5.   | Lake Volume (V)                                                            | $2.496 \times 10^6 \text{ m}^3$           |
| 6.   | Lake Mean Depth ( $Z = V/Ao$ )                                             | 2.35 m                                    |
| 7.   | Net Annual Runoff (r)                                                      | 0.051 m/yr                                |
| 8.   | Net Annual Evaporation ( $E_v$ )                                           | -0.130 m/yr                               |
| 9.   | Outflow $Q = [Ad \cdot r] + E_v \cdot [Ao + Ao_1]$                         | $1.999 \times 10^5 \text{ m}^3/\text{yr}$ |
| 10.  | Flushing Rate ( $p = Q/V$ )                                                | 0.080 times/yr                            |
| 11.  | Areal Water Load ( $qs = Q/Ao$ )                                           | 0.188 m/yr                                |
| 12.  | Retention Coefficient ( $R = 13.2/13.2 + qs$ )                             | 0.986                                     |
| 13.  | P Loading Rate for Precipitation ( $L_{Pr}$ )                              | $41 \text{ mg/m}^2/\text{yr}$             |
| 14.  | P Contribution from Precipitation ( $J_{Pr} = L_{Pr} \cdot Ao$ )           | $4.362 \times 10^7 \text{ mg/yr}$         |
| 15.  | P Export Coefficient (E)                                                   | $23.3 \text{ mg/m}^2/\text{yr}$           |
| 16.  | P Contribution from Drainage Basin ( $J_D = E \cdot Ad$ )                  | $1.703 \times 10^8 \text{ mg/yr}$         |
| 17.  | Total P from Natural Sources ( $J_N = J_{Pr} + J_D$ )                      | $2.139 \times 10^8 \text{ mg/yr}$         |
| 18.  | P Contribution per Capita Year (S)                                         | $8.0 \times 10^5 \text{ mg/yr}$           |
| 19.  | Sewage Treatment Retention Coefficient ( $R_S$ )                           | 0.63                                      |
| 20.  | Total Campground Site Units (U)                                            | 3 units                                   |
| 21.  | Mean Persons per Unit (P)                                                  | 1.51 persons/unit                         |
| 22.  | Mean Season Length (SL)                                                    | 85 days                                   |
| 23.  | Campground Capita Years ( $N_{CY}' = [U \cdot P \cdot SL]/365$ )           | 1.05 capita years                         |
| 24.  | P Contribution from Campground ( $J_A' = S \cdot N_{CY}' [1 - R_S]$ )      | $3.108 \times 10^5 \text{ mg/yr}$         |
| 25.  | Number of Cottages ( $N_C$ )                                               | 0 units                                   |
| 26.  | Capita Years per Cottage ( $P_C$ )                                         | 0.63 capita years                         |
| 27.  | Number of Residences ( $N_D$ )                                             | 1 unit                                    |
| 28.  | Capita Years per Residence ( $P_D$ )                                       | 4.3 capita years                          |
| 29.  | Total Occupant Capita Years ( $N_{CY}'' = P_C \cdot N_C + P_D \cdot N_D$ ) | 4.3 capita years                          |
| 30.  | P Contribution from Occupants ( $J_A'' = S \cdot N_{CY}'' [1 - R_S]$ )     | $1.273 \times 10^6 \text{ mg/yr}$         |
| 31.  | Total P from Artificial Sources ( $J_A = J_A' + J_A''$ )                   | $1.584 \times 10^6 \text{ mg/yr}$         |
| 32.  | Total P Supply ( $J_T = J_N + J_A$ )                                       | $2.155 \times 10^8 \text{ mg/yr}$         |
| 33.  | Predicted Spring Total P Concentration ( $P = [J_T(1-R)]/Q$ )              | 0.015 mg/L                                |

TABLE 15: CALCULATION PROCESS FOR THE SEECH LAKE PHOSPHORUS BUDGET.

| STEP | PARAMETER                                                                                                          | QUANTITATION                             |
|------|--------------------------------------------------------------------------------------------------------------------|------------------------------------------|
| 1.   | Gross Drainage Basin (A)                                                                                           | $9.872 \times 10^6 \text{ m}^2$          |
| 2.   | Lake Surface Area (Ao)                                                                                             | $8.72 \times 10^5 \text{ m}^2$           |
| 3.   | Surface Area of Other Lakes in A (Ao <sub>1</sub> )                                                                | $9.0 \times 10^4 \text{ m}^2$            |
| 4.   | Drainage Basin (Ad = A - [Ao + Ao <sub>1</sub> ])                                                                  | $8.910 \times 10^6 \text{ m}^2$          |
| 5.   | Lake Volume (V)                                                                                                    | $5.792 \times 10^6 \text{ m}^3$          |
| 6.   | Lake Mean Depth (Z = V/Ao)                                                                                         | 6.64 m                                   |
| 7.   | Net Annual Runoff (r)                                                                                              | 0.051 m/yr                               |
| 8.   | Net Annual Evaporation (E <sub>v</sub> )                                                                           | -0.130 m/yr                              |
| 9.   | Outflow Q = [Ad·r] + E <sub>v</sub> ·[Ao + Ao <sub>1</sub> ]                                                       | $3.29 \times 10^5 \text{ m}^3/\text{yr}$ |
| 10.  | Flushing Rate (p = Q/V)                                                                                            | 0.057 times/yr                           |
| 11.  | Areal Water Load (qs = Q/Ao)                                                                                       | 0.377 m/yr                               |
| 12.  | Retention Coefficient (R = 13.2/13.2 + qs)                                                                         | 0.972                                    |
| 13.  | P Loading Rate for Precipitation (L <sub>Pr</sub> )                                                                | 41 mg/m <sup>2</sup> /yr                 |
| 14.  | P Contribution from Precipitation (J <sub>Pr</sub> = L <sub>Pr</sub> ·Ao)                                          | $3.575 \times 10^7 \text{ mg/yr}$        |
| 15.  | P Export Coefficient (E)                                                                                           | 23.3 mg/m <sup>2</sup> /yr               |
| 16.  | P Contribution from Drainage Basin (J <sub>D</sub> = E·Ad)                                                         | $2.076 \times 10^8 \text{ mg/yr}$        |
| 17.  | Total P from Natural Sources (J <sub>N</sub> = J <sub>Pr</sub> + J <sub>D</sub> )                                  | $2.434 \times 10^8 \text{ mg/yr}$        |
| 18.  | P Contribution per Capita Year (S)                                                                                 | $8.0 \times 10^5 \text{ mg/yr}$          |
| 19.  | Sewage Treatment Retention Coefficient (R <sub>S</sub> )                                                           | 0.63                                     |
| 20.  | Total Campground Site Units (U)                                                                                    | 0 units*                                 |
| 21.  | Mean Persons per Unit (P)                                                                                          | 1.51 persons/unit                        |
| 22.  | Mean Season Length (SL)                                                                                            | 85 days                                  |
| 23.  | Campground Capita Years (N <sub>CY</sub> ' = [U·P·SL]/365)                                                         | 0 capita years                           |
| 24.  | P Contribution from Campground (J <sub>A</sub> ' = S·N <sub>CY</sub> '[1-R <sub>S</sub> ])                         | 0 mg/yr                                  |
| 25.  | Number of Cottages (N <sub>C</sub> )                                                                               | 6 units                                  |
| 26.  | Capita Years per Cottage (P <sub>C</sub> )                                                                         | 0.63 capita years                        |
| 27.  | Number of Residences (N <sub>D</sub> )                                                                             | 1 unit                                   |
| 28.  | Capita Years per Residence (P <sub>D</sub> )                                                                       | 4.3 capita years                         |
| 29.  | Total Occupant Capita Years (N <sub>CY</sub> " = P <sub>C</sub> ·N <sub>C</sub> + P <sub>D</sub> ·N <sub>D</sub> ) | 8.08 capita years                        |
| 30.  | P Contribution from Occupants (J <sub>A</sub> " = S·N <sub>CY</sub> "[1-R <sub>S</sub> ])                          | $2.392 \times 10^6 \text{ mg/yr}$        |
| 31.  | Total P from Artificial Sources (J <sub>A</sub> = J <sub>A</sub> ' + J <sub>A</sub> " )                            | $2.392 \times 10^8 \text{ mg/yr}$        |
| 32.  | Total P Supply (J <sub>T</sub> = J <sub>N</sub> + J <sub>A</sub> )                                                 | $2.458 \times 10^8 \text{ mg/yr}$        |
| 33.  | Predicted Spring Total P Concentration (P = [J <sub>T</sub> (1-R)]/Q)                                              | 0.021 mg/L                               |

\* The campground (50 units) is excluded since two central pumpout systems ensure that phosphorus is exported from the drainage basin.

TABLE 16: CALCULATION PROCESS FOR THE STEWART LAKE PHOSPHORUS BUDGET.

| STEP | PARAMETER                                                                                                          | QUANTITATION                              |
|------|--------------------------------------------------------------------------------------------------------------------|-------------------------------------------|
| 1.   | Gross Drainage Basin (A)                                                                                           | $4.573 \times 10^7 \text{ m}^2$           |
| 2.   | Lake Surface Area (A <sub>o</sub> )                                                                                | $2.616 \times 10^6 \text{ m}^2$           |
| 3.   | Surface Area of Other Lakes in A (A <sub>o1</sub> )                                                                | $1.180 \times 10^6 \text{ m}^2$           |
| 4.   | Drainage Basin (Ad = A - [A <sub>o</sub> + A <sub>o1</sub> ])                                                      | $4.193 \times 10^7 \text{ m}^2$           |
| 5.   | Lake Volume (V)                                                                                                    | $4.732 \times 10^6 \text{ m}^3$           |
| 6.   | Lake Mean Depth (Z = V/A <sub>o</sub> )                                                                            | 1.81 m                                    |
| 7.   | Net Annual Runoff (r)                                                                                              | 0.051 m/yr                                |
| 8.   | Net Annual Evaporation (E <sub>v</sub> )                                                                           | -0.130 m/yr                               |
| 9.   | Outflow Q = [Ad·r] + E <sub>v</sub> ·[A <sub>o</sub> + A <sub>o1</sub> ]                                           | $1.645 \times 10^6 \text{ m}^3/\text{yr}$ |
| 10.  | Flushing Rate (p = Q/V)                                                                                            | 0.348 times/yr                            |
| 11.  | Areal Water Load (qs = Q/A <sub>o</sub> )                                                                          | 0.629 m/yr                                |
| 12.  | Retention Coefficient (R = 13.2/13.2 + qs)                                                                         | 0.955                                     |
| 13.  | P Loading Rate for Precipitation (L <sub>Pr</sub> )                                                                | 41 mg/m <sup>2</sup> /yr                  |
| 14.  | P Contribution from Precipitation (J <sub>Pr</sub> = L <sub>Pr</sub> ·A <sub>o</sub> )                             | $1.073 \times 10^8 \text{ mg/yr}$         |
| 15.  | P Export Coefficient (E)                                                                                           | 23.3 mg/m <sup>2</sup> /yr                |
| 16.  | P Contribution from Drainage Basin (J <sub>D</sub> = E·Ad)                                                         | $9.770 \times 10^8 \text{ mg/yr}$         |
| 17.  | Total P from Natural Sources (J <sub>N</sub> = J <sub>Pr</sub> + J <sub>D</sub> )                                  | $1.084 \times 10^9 \text{ mg/yr}$         |
| 18.  | P Contribution per Capita Year (S)                                                                                 | $8.0 \times 10^5 \text{ mg/yr}$           |
| 19.  | Sewage Treatment Retention Coefficient (R <sub>S</sub> )                                                           | 0.63                                      |
| 20.  | Total Campground Site Units (U)                                                                                    | 10 units                                  |
| 21.  | Mean Persons per Unit (P)                                                                                          | 1.51 persons/unit                         |
| 22.  | Mean Season Length (SL)                                                                                            | 85 days                                   |
| 23.  | Campground Capita Years (N <sub>CY</sub> ' = [U·P·SL]/365)                                                         | 3.52 capita years                         |
| 24.  | P Contribution from Campground (J <sub>A</sub> ' = S·N <sub>CY</sub> '[1-R <sub>S</sub> ])                         | $1.041 \times 10^6 \text{ mg/yr}$         |
| 25.  | Number of Cottages (N <sub>C</sub> )                                                                               | 1 unit                                    |
| 26.  | Capita Years per Cottage (P <sub>C</sub> )                                                                         | 0.63 capita years                         |
| 27.  | Number of Residences (N <sub>D</sub> )                                                                             | 2 units                                   |
| 28.  | Capita Years per Residence (P <sub>D</sub> )                                                                       | 4.3 capita years                          |
| 29.  | Total Occupant Capita Years (N <sub>CY</sub> " = P <sub>C</sub> ·N <sub>C</sub> + P <sub>D</sub> ·N <sub>D</sub> ) | 9.23 capita years                         |
| 30.  | P Contribution from Occupants (J <sub>A</sub> " = S·N <sub>CY</sub> "[1-R <sub>S</sub> ])                          | $7.384 \times 10^6 \text{ mg/yr}$         |
| 31.  | Total P from Artificial Sources (J <sub>A</sub> = J <sub>A</sub> ' + J <sub>A</sub> " )                            | $8.425 \times 10^6 \text{ mg/yr}$         |
| 32.  | Total P Supply (J <sub>T</sub> = J <sub>N</sub> + J <sub>A</sub> )                                                 | $1.092 \times 10^9 \text{ mg/yr}$         |
| 33.  | Predicted Spring Total P Concentration (P = [J <sub>T</sub> (1-R)]/Q)                                              | 0.030 mg/L                                |

TABLE 17: CARLSON'S (1977) INDICES AS A TEST FOR THE VALIDITY OF  
USING THEORETICAL MEANS TO EVALUATE THE PHOSPHORUS BUDGETS

| LAKE                  | TSI-P <sup>1</sup> | TSI-SD <sup>2</sup> | TSI-Chl <sup>3</sup> | TSI  | RANGE DIFFERENCE<br>/TSI | VALIDITY <sup>4</sup> |
|-----------------------|--------------------|---------------------|----------------------|------|--------------------------|-----------------------|
| Ditch (Gertrude)      | 54.6               | 52.7                | 57.6                 | 55.0 | 0.089                    | valid                 |
| Kerr                  | 52.7               | 49.2                | 52.5                 | 51.5 | 0.068                    | valid                 |
| Otter                 | 70.1               | 77.9                | 69.0                 | 72.3 | 0.123                    | valid                 |
| Little Jackfish       | 76.4               | 67.9                | 67.5                 | 70.6 | 0.126                    | valid                 |
| Sandy                 | 52.7               | 47.0                | 50.9                 | 50.2 | 0.114                    | valid                 |
| Crawford (St. Dalmas) | 55.4               | 44.6                | 42.8                 | 47.6 | 0.265                    | not valid             |
| Thomas                | 50.0               | 45.9                | 45.3                 | 47.1 | 0.100                    | valid                 |
| Czornyj (Horod)       | 44.2               | 44.0                | 74.2                 | 54.1 | 0.558                    | not valid             |
| Dummy (Blue)          | 53.7               | 49.7                | 48.5                 | 50.6 | 0.103                    | valid                 |
| Imrie                 | 43.2               | 44.1                | 52.8                 | 46.7 | 0.206                    | not valid             |
| Seech                 | 50.6               | 42.0                | 45.3                 | 46.0 | 0.187                    | valid                 |
| Stewart               | 51.7               | 50.1                | 49.9                 | 50.6 | 0.036                    | valid                 |

1. Per equation 5
2. Per equation 3
3. Per equation 4
4. Deemed valid where range difference/TSI < 0.2

Little Jackfish, Sandy, Thomas, Dummy, Seech and Stewart Lakes. However, chlorophyll a concentrations were deemed unsuitable for evaluation of the phosphorus budgets of Crawford, Czornyj and Imrie lakes. This was because of significant chlorophyll a inhibition on Crawford Lake and enhanced production on the latter two lakes.

The phosphorus budgets of nine lakes were theoretically evaluated (Table 18) by substitution of observed chlorophyll a concentrations in the formulae of Dillon and Rigler (1974) and Riley and Prepas (1985), (equations 1(b) and 2(b), respectively). The results indicated that the observed chlorophyll a production in Otter and Little Jackfish lakes required significantly greater concentrations of total phosphorus than were predicted by the respective phosphorus budgets. This meant that the phosphorus budgets calculated for these two lakes (Tables 7 and 8, respectively) were not valid and could not be used for predictive purposes. Conversely, the results indicated that the observed chlorophyll a production in Ditch, Kerr, Sandy, Thomas, Dummy, Seech and Stewart lakes theoretically did not require significantly different concentrations of total phosphorus than were predicted by the respective phosphorus budgets. It was concluded that the phosphorus budgets calculated for these seven lakes (Tables 5, 6, 9, 11, 13, 15 and 16, respectively) were theoretically valid and could be used for predictive purposes.

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\* Corrective factors which might be extracted from the work of Barica (1977) and Barica et al (1978) cannot be applied because these researchers considered soluble reactive phosphorus as opposed to the total phosphorus of the present study.

TABLE 18: VALIDATION OF PHOSPHORUS BUDGET BY THEORETICAL CALCULATIONS

| LAKE                  | CALCULATED<br>[P] <sub>+5%</sub> * | CALCULATED<br>[P] <sub>+17%</sub> ** | ACCEPTABLE<br>RANGE OF [P] | PREDICTED<br>[P]*** | RANGE OF<br>PREDICTED [P] | VALIDITY  |
|-----------------------|------------------------------------|--------------------------------------|----------------------------|---------------------|---------------------------|-----------|
| Ditch (Gertrude)      | 0.034                              | 0.026                                | 0.036-0.022                | 0.019               | 0.023-0.015               | valid     |
| Kerr                  | 0.028                              | 0.021                                | 0.029-0.017                | 0.019               | 0.023-0.015               | valid     |
| Otter                 | 0.091                              | 0.080                                | 0.096-0.066                | 0.026               | 0.031-0.021               | not valid |
| Little Jackfish       | 0.082                              | 0.071                                | 0.086-0.059                | 0.016               | 0.019-0.013               | not valid |
| Sandy                 | 0.025                              | 0.018                                | 0.026-0.015                | 0.013               | 0.016-0.010               | valid     |
| Crawford (St. Dalmas) | Procedure not valid per Table 17   |                                      |                            |                     |                           | -         |
| Thomas                | 0.017                              | 0.012                                | 0.018-0.010                | 0.020               | 0.024-0.016               | valid     |
| Czornyj (Horod)       | Procedure not valid per Table 17   |                                      |                            |                     |                           | -         |
| Dummy (Blue)          | 0.021                              | 0.015                                | 0.022-0.012                | 0.015               | 0.018-0.012               | valid     |
| Imrie                 | Procedure not valid per Table 17   |                                      |                            |                     |                           | -         |
| Seech                 | 0.017                              | 0.012                                | 0.018-0.010                | 0.021               | 0.025-0.017               | valid     |
| Stewart               | 0.024                              | 0.017                                | 0.025-0.014                | 0.030               | 0.036-0.024               | valid     |

\* Per equation 1(b); converted to mg/L

\*\* Per equation 2(b); converted to mg/L

\*\*\* Per Tables 5-16, inclusive

The phosphorus budgets of all twelve lakes were also evaluated (Table 19) by comparison to observed mean fall and winter total phosphorus concentrations. The observed concentrations for five lakes fell outside of the acceptable range for predicted spring total phosphorus concentrations. This meant that the phosphorus budgets calculated for Otter, Little Jackfish, Sandy, Dummy and Stewart lakes (Tables 7, 8, 9, 13 and 16, respectively) were not valid and should not be used for predictive purposes. Comparison of predicted values to observed values was more restrictive than the theoretical evaluation because the phosphorus budgets calculated for Sandy, Dummy and Stewart lakes were invalidated by the former evaluation but not the latter. Therefore, to reduce the possibility of erroneous predictions, the results of the more restrictive evaluation process were considered accurate. The observed concentrations for seven lakes fell within the acceptable range for predicted spring total phosphorus concentrations. This meant that the phosphorus budgets calculated for Ditch, Kerr, Crawford, Thomas, Czornyj, Imrie and Seech lakes (Tables 5, 6, 10, 11, 12, 14 and 15, respectively) were valid and could be used for predictive purposes.

### 3.3 Trophic Status

Two of the key criteria upon which the study recommendations were founded included aesthetic considerations and the maintenance of environmental quality. Both criteria are difficult to evaluate, therefore, it was presumed that current conditions, though possibly not ideal, were at least minimally acceptable. This meant that

TABLE 19: VALIDATION OF PHOSPHORUS BUDGETS BY COMPARISON TO OBSERVED VALUES

| LAKE                  | PREDICTED<br>P (mg/L) | ACCEPTABLE<br>RANGE (mg/L) | FALL & WINTER<br>OBSERVED (mg/L) | MODEL<br>VALIDITY |
|-----------------------|-----------------------|----------------------------|----------------------------------|-------------------|
| Ditch (Gertrude)      | 0.019                 | 0.023-0.015                | 0.023                            | valid             |
| Kerr                  | 0.019                 | 0.023-0.015                | 0.020                            | valid             |
| Otter                 | 0.026                 | 0.031-0.021                | 0.068                            | not valid         |
| Little Jackfish       | 0.016                 | 0.019-0.013                | 0.153                            | not valid         |
| Sandy                 | 0.013                 | 0.016-0.010                | 0.024                            | not valid         |
| Crawford (St. Dalmas) | 0.025                 | 0.030-0.020                | 0.030                            | valid             |
| Thomas                | 0.020                 | 0.024-0.016                | 0.022                            | valid             |
| Czornyj (Horod)       | 0.017                 | 0.020-0.014                | 0.014                            | valid             |
| Dummy (Blue)          | 0.015                 | 0.018-0.012                | 0.029                            | not valid         |
| Imrie                 | 0.015                 | 0.018-0.012                | 0.012                            | valid             |
| Seech                 | 0.021                 | 0.025-0.017                | 0.020                            | valid             |
| Stewart               | 0.030                 | 0.036-0.024                | 0.022                            | not valid         |

the trophic status had to be determined and the stability of each lakes' condition had to be assessed.

Means of Carlson's (1977) indices were plotted in order to evaluate the trophic status of each lake (Figure 3). Vollenweider's (1975) plot (Figure 4) was used to assess the stability of the trophic states for those lakes where valid phosphorus budgets had been developed (Table 20).

Otter Lake and Little Jackfish Lake fell within the upper eutrophic range (Figure 3). This meant that these lakes were extremely productive and would experience major blooms of blue-green algae (Cyanophytes) virtually every year. Mid-winter and possibly even mid-summer oxygen depletion accompanied by fish kills are expected to occur frequently. Generally, the water quality of highly eutrophic lakes is not considered suitable for body contact recreation. The stability of environmental quality in both Otter and Little Jackfish lakes could not be assessed because valid phosphorus budgets were not developed for either lake.

Ditch Lake and Czornyj Lake fell into the moderately eutrophic range (Figure 3). This meant that these lakes were also very productive and will also frequently experience major blooms of Cyanophytes. Mid-winter oxygen depletions accompanied by fish kills would not be uncommon. Generally, the water quality of moderately eutrophic lakes is considered suitable for recreational purposes except during major Cyanophyte blooms. Vollenweider's (1975) plot (Figure 4) indicated that both Ditch Lake and Czornyj Lake were

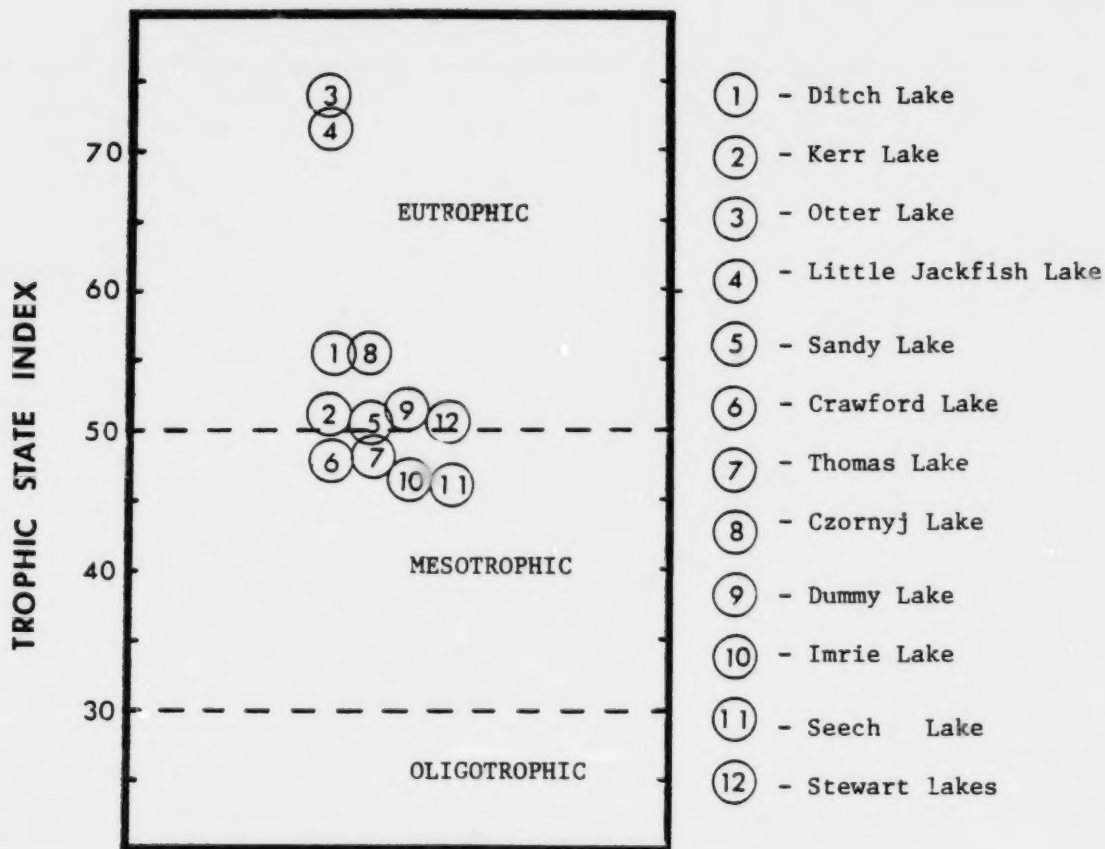
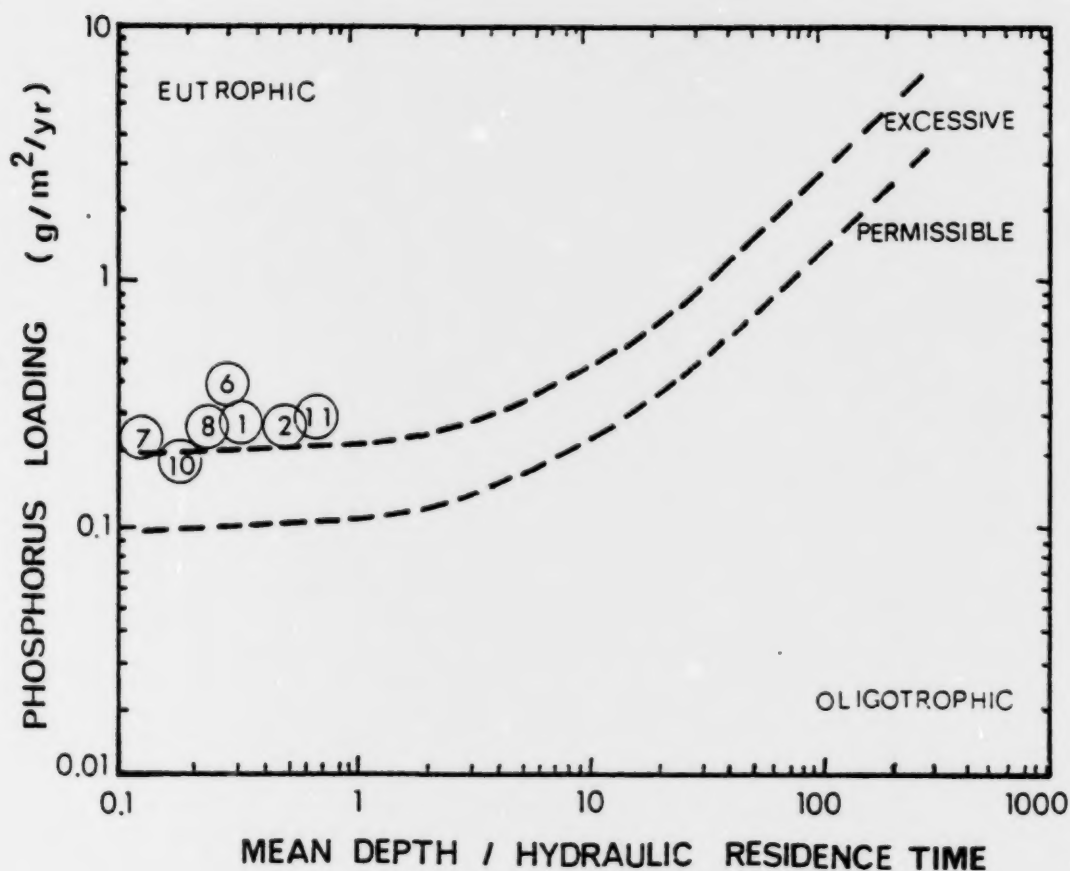


Figure 3: Carlson's (1977) mean trophic state indices (TSI) for the South Riding Mountain Planning District Lake.



- |                 |                |
|-----------------|----------------|
| ① Ditch Lake    | ⑧ Czornyj Lake |
| ② Kerr Lake     | ⑩ Imrie Lake   |
| ⑥ Crawford Lake | ⑪ Seech Lake   |
| ⑦ Thomas Lake   |                |

Figure 4: Application of Vollenweider's (1975) trophic state scale to lakes of the South Riding Mountain Planning District.

TABLE 20: PHOSPHORUS LOADING RATES AND (MEAN DEPTH/HYDRAULIC RESIDENCE TIME) FOR LAKES WITH VALID PHOSPHORUS BUDGETS

| Lake          | Phosphorus Loading<br>(g/M <sup>2</sup> /yr) | Mean Depth               | * |
|---------------|----------------------------------------------|--------------------------|---|
|               |                                              | Hydraulic Residence Time |   |
| Ditch Lake    | 0.26                                         | 0.276                    |   |
| Kerr Lake     | 0.26                                         | 0.313                    |   |
| Crawford Lake | 0.33                                         | 0.267                    |   |
| Thomas Lake   | 0.26                                         | 0.131                    |   |
| Czornyj Lake  | 0.23                                         | 0.245                    |   |
| Imrie Lake    | 0.20                                         | 0.188                    |   |
| Seech Lake    | 0.28                                         | 0.377                    |   |

\* This value is equivalent to qs from Tables 5, 6, 10, 11, 12, 14 and 15; respectively

subject to excessive rates of background phosphorus loadings. This meant that the water quality conditions of both waterbodies were expected to continue to deteriorate over time unless ameliorative action were taken.

Kerr Lake, Sandy Lake, Dummy Lake and Stewart Lake were classified as borderline between the mesotrophic and eutrophic states (Figure 3). However, field observations suggested that Sandy Lake was considerably more eutrophic than suggested by the mean TSI values. This was indicated by extensive macrophyte growths in deeper areas (2-3 meters) of the lake and by dense colonies of filamentous algae in shallower (<2 metres) areas. The magnitude of the macrophyte and filamentous algae growths may cause stripping of nutrients from the water column and sediments at an accelerated rate, thereby reducing the potential for Cyanophyte production and hence, artificially suppressing mean TSI values. Accordingly, the water quality of Sandy Lake might better be grouped with that of the moderately eutrophic Ditch and Czornyj Lakes and assessed in a similar manner. The stability of environmental conditions in Sandy Lake, however, could not be evaluated since a valid phosphorus budget was not developed for this waterbody.

Field observations suggested that Kerr Lake, Dummy Lake and Stewart Lake had been properly classified as borderline between the eutrophic and mesotrophic states. These lakes were also quite productive and might experience major blooms of Cyanophytes. However, the duration and magnitude of Cyanophyte blooms was expected to be considerably less than those which developed on the eutrophic waterbodies. Mid-winter oxygen depletions accompanied by fish kills

might occur infrequently. Generally, the water quality of such borderline lakes is considered suitable for recreational purposes. Vollenweider's (1975) plot (Figure 4) indicated that Kerr Lake was subject to excessive rates of phosphorus loadings. Therefore, the water quality of Kerr Lake was expected to continue to slowly deteriorate unless ameliorative action was taken. The stability of water quality conditions in Dummy and Stewart lakes could not be assessed since valid phosphorus budgets were not developed for these waterbodies.

Crawford Lake, Thomas Lake, Imrie Lake and Seech Lake fell within the mesotrophic range (Figure 3). However, field observations suggested that Imrie Lake was more eutrophic than suggested by the mean TSI values. Similar to Sandy Lake, these conditions were indicated by dense colonies of filamentous algae in shallower (<2 metres) areas. Also like Sandy Lake, the magnitude of the algal growth implied that nutrients were being stripped from the water column at an accelerated rate, thereby reducing the potential for Cyanophyte production. Hence, mean TSI values were thought to be artificially suppressed. Accordingly, the water quality of Imrie Lake might more appropriately be grouped with the borderline lakes and assessed in a similar manner. Vollenweider's (1975) plot (Figure 4) suggested that background phosphorus loading rates to Imrie Lake were on the verge of becoming excessive. The water quality of Imrie Lake was expected to remain fairly stable unless significant changes in land use practices occurred within the immediate watershed.

Field observations supported the classification of Crawford, Thomas and Seech lakes as mesotrophic waterbodies. The lakes were moderately productive and might occasionally experience algae blooms. These blooms, however, were not expected to be very severe nor were they expected to be of long duration. Mid-winter oxygen depletions and fish kills were expected to be a rare occurrence. Generally, the water quality of mesotrophic lakes is suitable for all recreational purposes. Vollenweider's (1975) plot (Figure 4) indicated that all three lakes were subject to excessive background rates of phosphorus loadings. Therefore, the water quality presently enjoyed by recreationers using Crawford, Thomas and Seech lakes, were expected to continue to slowly decline over time unless ameliorative action were taken. The water quality of Crawford Lake, however, was expected to decline at a somewhat faster rate than that of Thomas and Seech lakes due to a proportionately elevated rate of phosphorus loading.

#### 3.4 Cottage Equivalent Capacities

Cottage equivalent capacities,\* as previously discussed, are calculated according to procedures modified from Hough, Stansbury and Michalski Limited (1980). Capacities were calculated only for the seven lakes for which valid phosphorus budgets had been developed (Ditch, Kerr, Crawford, Thomas, Czornyj, Imrie, Seech).

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\* The term "cottage equivalent" implies that alternate uses can be readily accommodated by application of appropriate conversion factors. For example, when estimating phosphorus loadings, one cottage is equivalent to either 0.147 permanent residences, or to 4.5 campsites.

It was estimated that Ditch Lake has the ability to accommodate a maximum of 32 cottage equivalents without suffering detectable water quality degradation (Table 21). Because there are currently 154 cottages located at the lake (W. Dmyterko, pers. comm.) and because present alternate usage has been estimated at the equivalent of 30 campsites (Table 5), it was obvious that the capacity of the lake to absorb nutrients without suffering ill effects has been grossly exceeded. Therefore, it is recommended that further development at Ditch Lake not be permitted. It should also be noted that the water quality will continue to deteriorate at an ever-accelerating rate unless ameliorative action is undertaken. Since it is undesirable to attempt closure of existing facilities, it may be prudent to encourage the recreationers and local landowners themselves to undertake ameliorative measures. Such measures could include the installation of wastewater holding tanks at all cottages, campgrounds and day use facilities, as well as the planting of trees and shrub buffer zones around areas of shoreline that are currently devoid of this vegetation.

Kerr Lake has the estimated ability to accommodate a maximum of 55 cottage equivalents without a detectable deterioration of lake water quality (Table 22). Present alternate usage has been estimated at the equivalent of 25 campsites (Table 6). Sixteen cottage units are currently located at the site (W. Dmyterko, pers. comm.). Therefore, a further 33 cottage equivalents may be accommodated.

TABLE 21: CALCULATION PROCESS FOR ESTIMATION OF DITCH (GERTRUDE) LAKE  
COTTAGE EQUIVALENT CAPACITY

| STEP | PARAMETER                                                                                     | QUANTITATION                               |
|------|-----------------------------------------------------------------------------------------------|--------------------------------------------|
| 1.   | P Contribution per capita (S)                                                                 | $8.0 \times 10^5 \text{ mg/yr.}$           |
| 2.   | Sewage Treatment Retention Coefficient ( $R_s$ )                                              | 0.63                                       |
| 3.   | Capita Years per Cottage ( $P_c$ )                                                            | 0.63 capita years                          |
| 4.   | Total P supply ( $J_T$ )                                                                      | $2.582 \times 10^8 \text{ mg/yr.}$         |
| 5.   | Number of Cottages ( $N_C$ )                                                                  | 129 units*                                 |
| 6.   | Campground Capita Years ( $N_{CY}'$ )                                                         | 10.55 capita years                         |
| 7.   | Total Campground and Cottage Capita Years ( $N_{CY}^2 = P_c \cdot N_C + N_{CY}'$ )            | 91.82 capita years                         |
| 8.   | P Contributions from Cottages and Campgrounds ( $J_{C1} = N_{CY}^2 \cdot S \cdot [1 - R_s]$ ) | $2.718 \times 10^7 \text{ mg/yr}$          |
| 9.   | Significance of Non $-J_{C1}$ Contributions ( $K = [J_T - J_{C1}] / J_T$ )                    | 0.89                                       |
| 10.  | Predicted P (P)                                                                               | 0.019 mg/L                                 |
| 11.  | Predicted P minus $J_{C1}$ Contributions ( $P_1 = P \cdot K$ )                                | 0.017 mg/L                                 |
| 12.  | Analytical Error Associated with $P_1$ ( $E_1$ )                                              | 0.0017 mg/L                                |
| 13.  | Calculation Error Permitted ( $E = [E_1 / 4]$ )                                               | 0.43 $\mu\text{g/L}$                       |
| 14.  | Outflow (Q)                                                                                   | $2.767 \times 10^5 \text{ m}^3/\text{yr.}$ |
| 15.  | Retention Coefficient (R)                                                                     | 0.980                                      |
| 16.  | Permissible Cottage and Campground Loading ( $J_{CP} = E \cdot Q / [1 - R]$ )                 | $5.880 \times 10^6 \text{ mg/yr.}$         |
| 17.  | Permissible Number of Cottage Equivalents ( $N_{CE} = J_{CP} / [1 - R_s] \cdot P_c \cdot S$ ) | 32 units                                   |

\* 25 of 154 cottages possess holding tanks and are therefore excluded from the calculations.

TABLE 22: CALCULATION PROCESS FOR ESTIMATION OF KERR LAKE COTTAGE EQUIVALENT CAPACITY

| STEP | PARAMETER                                                                                     | QUANTITATION                               |
|------|-----------------------------------------------------------------------------------------------|--------------------------------------------|
| 1.   | P Contribution per capita (S)                                                                 | $8.0 \times 10^5 \text{ mg/yr.}$           |
| 2.   | Sewage Treatment Retention Coefficient ( $R_s$ )                                              | 0.63                                       |
| 3.   | Capita Years per Cottage ( $P_c$ )                                                            | 0.63 capita years                          |
| 4.   | Total P supply ( $J_T$ )                                                                      | $3.850 \times 10^8 \text{ mg/yr.}$         |
| 5.   | Number of Cottages ( $N_c$ )                                                                  | 12 units*                                  |
| 6.   | Campground Capita Years ( $N_{CY}'$ )                                                         | 8.79 capita years                          |
| 7.   | Total Campground and Cottage Capita Years ( $N_{CY}^2 = P_c \cdot N_c + N_{CY}'$ )            | 16.35 capita years                         |
| 8.   | P Contributions from Cottages and Campgrounds ( $J_{C1} = N_{CY}^2 \cdot S \cdot [1 - R_s]$ ) | $4.840 \times 10^6 \text{ mg/yr}$          |
| 9.   | Significance of Non $-J_{C1}$ Contributions ( $K = [J_T - J_{C1}] / J_T$ )                    | 0.987                                      |
| 10.  | Predicted P (P)                                                                               | 0.019 mg/L                                 |
| 11.  | Predicted P minus $J_{C1}$ Contributions ( $P_1 = P \cdot K$ )                                | 0.0188 mg/L                                |
| 12.  | Analytical Error Associated with $P_1$ ( $E_1$ )                                              | 0.002 mg/L                                 |
| 13.  | Calculation Error Permitted ( $E = [E_1 / 4]$ )                                               | 0.50 $\mu\text{g/L}$                       |
| 14.  | Outflow (Q)                                                                                   | $4.682 \times 10^5 \text{ m}^3/\text{yr.}$ |
| 15.  | Retention Coefficient (R)                                                                     | 0.977                                      |
| 16.  | Permissible Cottage and Campground Loading ( $J_{CP} = E \cdot Q / [1 - R]$ )                 | $5.568 \times 10^6 \text{ mg/yr.}$         |
| 17.  | Permissible Number of Cottage Equivalents ( $N_{CE} = J_{CP} / [1 - R_s] \cdot P_c \cdot S$ ) | 55 units                                   |

\* 4 of 16 cottages possess holding tanks and are therefore excluded from the calculations.

Therefore, it is recommended that future developments not exceed a lake total of 33 additional cottage equivalent units.\*

It was estimated that a total of 25 cottage equivalent units may be accommodated at Crawford Lake without a detectable environmental impact upon water quality (Table 23). Since present alternate usage has been estimated at the equivalent of 10 campsites (Table 10) and because 4 cottage units are currently located at the site (W. Dmyterko, pers. comm.), only a further 19 cottage equivalent units may be accommodated. Therefore, it is recommended that future developments not exceed a lake total of 19 additional cottage units.\* Furthermore, it has previously been noted that Crawford Lake was subject to an accelerated rate of background phosphorus loading as compared to other lakes studied (Figure 3). Therefore, it may also be prudent to encourage local land owners and recreationers to undertake ameliorative action in order to retard the rate of background water quality deterioration. The best course of such action may be to establish tree and shrub buffer zones around the approximately 85% of currently exposed shoreline.

It has been estimated that a total of 108 cottage equivalent units may be accommodated at Thomas Lake without a detectable environmental impact upon water quality (Table 24). Since present alternate usage has been estimated at the equivalent of 45 campsites (Table 11) only 98 cottages may be accommodated. Because this closely

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\* Note the qualification : cited within Section 3.5.

TABLE 23: CALCULATION PROCESS FOR ESTIMATION OF CRAWFORD (ST. DALMAS) LAKE  
COTTAGE EQUIVALENT CAPACITY

| <u>STEP</u> | <u>PARAMETER</u>                                                                              | <u>QUANTITATION</u>                        |
|-------------|-----------------------------------------------------------------------------------------------|--------------------------------------------|
| 1.          | P Contribution per capita (S)                                                                 | $8.0 \times 10^5 \text{ mg/yr.}$           |
| 2.          | Sewage Treatment Retention Coefficient ( $R_s$ )                                              | 0.63                                       |
| 3.          | Capita Years per Cottage ( $P_C$ )                                                            | 0.63 capita years                          |
| 4.          | Total P supply ( $J_T$ )                                                                      | $2.255 \times 10^8 \text{ mg/yr.}$         |
| 5.          | Number of Cottages ( $N_C$ )                                                                  | 4 units                                    |
| 6.          | Campground Capita Years ( $N_{CY}'$ )                                                         | 3.52 capita years                          |
| 7.          | Total Campground and Cottage Capita Years ( $N_{CY}^2 = P_C \cdot N_C + N_{CY}'$ )            | 6.04 capita years                          |
| 8.          | P Contributions from Cottages and Campgrounds ( $J_{C1} = N_{CY}^2 \cdot S \cdot [1 - R_s]$ ) | $1.788 \times 10^6 \text{ mg/yr}$          |
| 9.          | Significance of Non $-J_{C1}$ Contributions ( $K = [J_T - J_{C1}] / J_T$ )                    | 0.992                                      |
| 10.         | Predicted P (P)                                                                               | 0.025 mg/L                                 |
| 11.         | Predicted P minus $J_{C1}$ Contributions ( $P_1 = P \cdot K$ )                                | 0.0248 mg/L                                |
| 12.         | Analytical Error Associated with $P_1$ ( $E_1$ )                                              | 0.002 mg/L                                 |
| 13.         | Calculation Error Permitted ( $E = [E_1 / 4]$ )                                               | 0.50 $\mu\text{g/L}$                       |
| 14.         | Outflow (Q)                                                                                   | $1.838 \times 10^5 \text{ m}^3/\text{yr.}$ |
| 15.         | Retention Coefficient (R)                                                                     | 0.980                                      |
| 16.         | Permissible Cottage and Campground Loading ( $J_{CP} = E \cdot Q / [1 - R]$ )                 | $4.595 \times 10^6 \text{ mg/yr.}$         |
| 17.         | Permissible Number of Cottage Equivalents ( $N_{CE} = J_{CP} / [1 - R_s] \cdot P_C \cdot S$ ) | 25 units                                   |

TABLE 24: CALCULATION PROCESS FOR ESTIMATION OF THOMAS LAKE COTTAGE EQUIVALENT CAPACITY

| STEP | PARAMETER                                                                                     | QUANTITATION                               |
|------|-----------------------------------------------------------------------------------------------|--------------------------------------------|
| 1.   | P Contribution per capita ( $S$ )                                                             | $8.0 \times 10^5 \text{ mg/yr.}$           |
| 2.   | Sewage Treatment Retention Coefficient ( $R_s$ )                                              | 0.63                                       |
| 3.   | Capita Years per Cottage ( $P_C$ )                                                            | 0.63 capita years                          |
| 4.   | Total P supply ( $J_T$ )                                                                      | $7.994 \times 10^8 \text{ mg/yr.}$         |
| 5.   | Number of Cottages ( $N_C$ )                                                                  | 65 units*                                  |
| 6.   | Campground Capita Years ( $N_{CY}'$ )                                                         | 15.82 capita years                         |
| 7.   | Total Campground and Cottage Capita Years ( $N_{CY}^2 = P_C \cdot N_C + N_{CY}'$ )            | 56.77 capita years                         |
| 8.   | P Contributions from Cottages and Campgrounds ( $J_{C1} = N_{CY}^2 \cdot S \cdot [1 - R_s]$ ) | $1.680 \times 10^7 \text{ mg/yr}$          |
| 9.   | Significance of Non $-J_{C1}$ Contributions ( $K = [J_T - J_{C1}] / J_T$ )                    | 0.979                                      |
| 10.  | Predicted P ( $P$ )                                                                           | 0.020 mg/L                                 |
| 11.  | Predicted P minus $J_{C1}$ Contributions ( $P_1 = P \cdot K$ )                                | 0.0196 mg/L                                |
| 12.  | Analytical Error Associated with $P_1$ ( $E_1$ )                                              | 0.002 mg/L                                 |
| 13.  | Calculation Error Permitted ( $E = [E_1 / 4]$ )                                               | 0.50 $\mu\text{g/L}$                       |
| 14.  | Outflow ( $Q$ )                                                                               | $4.026 \times 10^5 \text{ m}^3/\text{yr.}$ |
| 15.  | Retention Coefficient ( $R$ )                                                                 | 0.990                                      |
| 16.  | Permissible Cottage and Campground Loading ( $J_{CP} = E \cdot Q / [1 - R]$ )                 | $2.013 \times 10^7 \text{ mg/yr.}$         |
| 17.  | Permissible Number of Cottage Equivalents ( $N_{CE} = J_{CP} / [1 - R_s] \cdot P_C \cdot S$ ) | 108 units                                  |

\* 27 of the 92 cottages/seasonal trailer lots are equipped with holding tanks and are therefore excluded from the calculations.

approximate the present development of 92 cottages/seasonal trailer lots (W. Dmyterko, pers. comm.), it is recommended that further developments not be permitted. This recommendation is consistent with that of Brown and Beck (1980).

It was estimated that a total of 14 cottage equivalent units may be accommodated at Czornyj Lake without a detectable environmental impact upon water quality (Table 25). Since present alternate usage has been estimated at the equivalent of 5 campsites (Table 12) and because 2 cottages are currently located at the site (W. Dmyterko, pers. comm.), only a further 11 cottage equivalent units may be accommodated. Therefore it is recommended that future developments not exceed a lake total of 11 additional cottage equivalent units.\*

It was estimated that a total of 29 cottage equivalent units may be accommodated at Imrie Lake without a detectable environmental impact upon water quality (Table 26). Since present alternate usage has been estimated at the equivalent of 3 campsites (Table 14) only a further 28 cottage equivalent units may be accommodated. However, it was noted that phosphorus loading rates to Imrie Lake were on the verge of becoming excessive and water quality conditions might not remain stable if significant disturbance of land surface occurred within the immediate watershed (Section 3.3). Thus it is recommended that future developments not exceed a lake total of 28 additional cottage equivalent units\* and that proponents of such development exercise extreme care to keep land surface disturbance to a minimum.

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\* Note the qualifications cited within Section 3.5.

TABLE 25: CALCULATION PROCESS FOR ESTIMATION OF CZORNYJ (HOROD) LAKE  
COTTAGE EQUIVALENT CAPACITY

| <u>STEP</u> | <u>PARAMETER</u>                                                                              | <u>QUANTITATION</u>                        |
|-------------|-----------------------------------------------------------------------------------------------|--------------------------------------------|
| 1.          | P Contribution per capita (S)                                                                 | $8.0 \times 10^5 \text{ mg/yr.}$           |
| 2.          | Sewage Treatment Retention Coefficient ( $R_s$ )                                              | 0.63                                       |
| 3.          | Capita Years per Cottage ( $P_c$ )                                                            | 0.63 capita years                          |
| 4.          | Total P supply ( $J_T$ )                                                                      | $1.121 \times 10^8 \text{ mg/yr.}$         |
| 5.          | Number of Cottages ( $N_c$ )                                                                  | 2 units                                    |
| 6.          | Campground Capita Years ( $N_{CY}'$ )                                                         | 1.76 capita years                          |
| 7.          | Total Campground and Cottage Capita Years ( $N_{CY}^2 = P_c \cdot N_c + N_{CY}'$ )            | 3.02 capita years                          |
| 8.          | P Contributions from Cottages and Campgrounds ( $J_{C1} = N_{CY}^2 \cdot S \cdot [1 - R_s]$ ) | $8.939 \times 10^5 \text{ mg/yr}$          |
| 9.          | Significance of Non $-J_{C1}$ Contributions ( $K = [J_T - J_{C1}] / J_T$ )                    | 0.992                                      |
| 10.         | Predicted P (P)                                                                               | 0.017 mg/L                                 |
| 11.         | Predicted P minus $J_{C1}$ Contributions ( $P_1 = P \cdot K$ )                                | 0.01686 mg/L                               |
| 12.         | Analytical Error Associated with $P_1$ ( $E_1$ )                                              | 0.0015 mg/L                                |
| 13.         | Calculation Error Permitted ( $E = [E_1 / 4]$ )                                               | 0.38 $\mu\text{g/L}$                       |
| 14.         | Outflow (Q)                                                                                   | $1.211 \times 10^5 \text{ m}^3/\text{yr.}$ |
| 15.         | Retention Coefficient (R)                                                                     | 0.982                                      |
| 16.         | Permissible Cottage and Campground Loading ( $J_{CP} = E \cdot Q / [1 - R]$ )                 | $2.523 \times 10^6 \text{ mg/yr.}$         |
| 17.         | Permissible Number of Cottage Equivalents ( $N_{CE} = J_{CP} / [1 - R_s] \cdot P_c \cdot S$ ) | 14 units                                   |

TABLE 26: CALCULATION PROCESS FOR ESTIMATION OF IMRIE LAKE COTTAGE EQUIVALENT CAPACITY

| STEP | PARAMETER                                                                                     | QUANTITATION                            |
|------|-----------------------------------------------------------------------------------------------|-----------------------------------------|
| 1.   | P Contribution per capita (S)                                                                 | $8.0 \times 10^5$ mg/yr.                |
| 2.   | Sewage Treatment Retention Coefficient ( $R_s$ )                                              | 0.63                                    |
| 3.   | Capita Years per Cottage ( $P_C$ )                                                            | 0.63 capita years                       |
| 4.   | Total P supply ( $J_T$ )                                                                      | $2.155 \times 10^8$ mg/yr.              |
| 5.   | Number of Cottages ( $N_C$ )                                                                  | 0 units                                 |
| 6.   | Campground Capita Years ( $N_{CY}'$ )                                                         | 1.05 capita years                       |
| 7.   | Total Campground and Cottage Capita Years ( $N_{CY}^2 = P_C \cdot N_C + N_{CY}'$ )            | 1.05 capita years                       |
| 8.   | P Contributions from Cottages and Campgrounds ( $J_{C1} = N_{CY}^2 \cdot S \cdot [1 - R_s]$ ) | $3.108 \times 10^5$ mg/yr               |
| 9.   | Significance of Non $-J_{C1}$ Contributions ( $K = [J_T - J_{C1}] / J_T$ )                    | 0.999                                   |
| 10.  | Predicted P (P)                                                                               | 0.015 mg/L                              |
| 11.  | Predicted P minus $J_{C1}$ Contributions ( $P_1 = P \cdot K$ )                                | 0.01498 mg/L                            |
| 12.  | Analytical Error Associated with $P_1$ ( $E_1$ )                                              | 0.0015 mg/L                             |
| 13.  | Calculation Error Permitted ( $E = [E_1 / 4]$ )                                               | 0.38 $\mu$ g/L                          |
| 14.  | Outflow (Q)                                                                                   | $1.999 \times 10^5$ m <sup>3</sup> /yr. |
| 15.  | Retention Coefficient (R)                                                                     | 0.986                                   |
| 16.  | Permissible Cottage and Campground Loading ( $J_{CP} = E \cdot Q / [1 - R]$ )                 | $5.354 \times 10^6$ mg/yr.              |
| 17.  | Permissible Number of Cottage Equivalents ( $N_{CE} = J_{CP} / [1 - R_s] \cdot P_C \cdot S$ ) | 29 units                                |

It was estimated that Seech Lake has the ability to accommodate 32 cottage equivalent units without a detectable environmental impact upon water quality (Table 27). Since present alternate usage has been estimated to contribute virtually no phosphorus to the lake (Table 15) and because 6 cottages are currently located at the site (W. Dmyterko, pers. comm), a further 26 cottage equivalent units may be accommodated. Therefore, it is recommended that future developments not exceed a lake total of 26 additional cottage equivalent units\*.

Valid phosphorus budgets were not developed for Otter Lake, Little Jackfish Lake, Sandy Lake, Dummy Lake and Stewart Lake. Therefore, cottage equivalent capacities could not be estimated for these waterbodies. In order to accurately estimate the cottage equivalent capacities of these five lakes, further water quality studies are required. Therefore, it is recommended that additional water quality studies be undertaken on Otter, Little Jackfish, Sandy, Dummy and Stewart lakes. It is further recommended that proposed developments for these five waterbodies be postponed until completion and interpretation of the additional water quality studies.

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\* Note that Section 3.5 suggests boating capacity has been exceeded and that special controls may therefore be required for existing and future developments.

TABLE 27: CALCULATION PROCESS FOR ESTIMATION OF SEECH LAKE COTTAGE EQUIVALENT CAPACITY

| STEP | PARAMETER                                                                                     | QUANTITATION                               |
|------|-----------------------------------------------------------------------------------------------|--------------------------------------------|
| 1.   | P Contribution per capita (S)                                                                 | $8.0 \times 10^5 \text{ mg/yr.}$           |
| 2.   | Sewage Treatment Retention Coefficient ( $R_s$ )                                              | 0.63                                       |
| 3.   | Capita Years per Cottage ( $P_c$ )                                                            | 0.63 capita years                          |
| 4.   | Total P supply ( $J_T$ )                                                                      | $2.458 \times 10^8 \text{ mg/yr.}$         |
| 5.   | Number of Cottages ( $N_C$ )                                                                  | 6 units                                    |
| 6.   | Campground Capita Years ( $N_{CY}'$ )                                                         | 0 capita years*                            |
| 7.   | Total Campground and Cottage Capita Years ( $N_{CY}^2 = P_c \cdot N_C + N_{CY}'$ )            | 3.78 capita years                          |
| 8.   | P Contributions from Cottages and Campgrounds ( $J_{C1} = N_{CY}^2 \cdot S \cdot [1 - R_s]$ ) | $1.119 \times 10^6 \text{ mg/yr}$          |
| 9.   | Significance of Non $-J_{C1}$ Contributions ( $K = [J_T - J_{C1}] / J_T$ )                    | 0.995                                      |
| 10.  | Predicted P (P)                                                                               | 0.021 mg/L                                 |
| 11.  | Predicted P minus $J_{C1}$ Contributions ( $P_1 = P \cdot K$ )                                | 0.0209 mg/L                                |
| 12.  | Analytical Error Associated with $P_1$ ( $E_1$ )                                              | 0.002 mg/L                                 |
| 13.  | Calculation Error Permitted ( $E = [E_1 / 4]$ )                                               | 0.50 $\mu\text{g/L}$                       |
| 14.  | Outflow (Q)                                                                                   | $3.299 \times 10^5 \text{ m}^3/\text{yr.}$ |
| 15.  | Retention Coefficient (R)                                                                     | 0.972                                      |
| 16.  | Permissible Cottage and Campground Loading ( $J_{CP} = E \cdot Q / [1 - R]$ )                 | $5.875 \times 10^6 \text{ mg/yr.}$         |
| 17.  | Permissible Number of Cottage Equivalents ( $N_{CE} = J_{CP} / [1 - R_s] \cdot P_c \cdot S$ ) | 32 units                                   |

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\* The 50 unit campground is excluded since two central pumpout systems service the facility.

### 3.5 Boat Capacities\*

Boat capacities are calculated in order to assess the potential for conflicts among various users. Such conflicts may be mechanical (e.g. collisions), physical interference which creates hazardous conditions (e.g. waterskiing and swimming), or psychological interference (e.g. still fishing and high speed boating) (Thomas, 1983). Boat capacities may also be used as an aid to guide development. They are of particular assistance when current boating practices are moderate to heavy but the potential for development has not been fully realized.

It was estimated that current boating use of Ditch Lake approximated 325% of capacity (Table 28). This meant that there was a significant potential for a serious boating accident to occur. Furthermore, due to overcrowding, recreationers at Ditch Lake likely experienced considerable impairment of the aesthetics normally associated with water based recreational activities. Clearly, some action should be taken to reduce the potential for a serious accident and to reduce the level of non contact interferences. Therefore, it is recommended that local authorities consider imposing restrictions upon power boats operating on Ditch Lake.

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\* Within the context of this report, the term "boat" refers to all water crafts including motorboats, canoes, sailboats, sailboards, pedal boats, rafts, etc.

TABLE 28: BOAT CAPACITIES FOR LAKES OF THE SOUTH RIDING MOUNTAIN PLANNING DISTRICT.

| Lake            | Lake Surface Area >1.5 m Depth (ha) | Maximum Instantaneous Boat Capacity (Boats) | Maximum Instantaneous Current Use (Boats) | Capacity - Current Use (Boats) | Current Use /Capacity (%) |
|-----------------|-------------------------------------|---------------------------------------------|-------------------------------------------|--------------------------------|---------------------------|
| Ditch           | 62                                  | 12                                          | 39                                        | -27                            | 325%                      |
| Kerr            | 133                                 | 25                                          | 13                                        | 12                             | 52%                       |
| Otter           | 499                                 | 95                                          | 35                                        | 60                             | 37%                       |
| Little Jackfish | 61                                  | 12                                          | 1                                         | 11                             | 8%                        |
| Sandy           | 405                                 | 77                                          | 44                                        | 33                             | 57%                       |
| Crawford        | 51                                  | 10                                          | 5                                         | 5                              | 50%                       |
| Thomas          | 234                                 | 44                                          | 30                                        | 14                             | 68%                       |
| Czornyj         | 31                                  | 6                                           | 2                                         | 4                              | 33%                       |
| Dummy           | 110                                 | 21                                          | 1                                         | 20                             | 5%                        |
| Imrie           | 58                                  | 11                                          | 1                                         | 10                             | 9%                        |
| Seech           | 77                                  | 15                                          | 21                                        | -6                             | 140%                      |
| Stewart         | 210                                 | 40                                          | 6                                         | 34                             | 15%                       |

It was estimated that up to 25 boats may operate safely on Kerr Lake at any one time (Table 28). Current boating use approximated 52% of capacity (Ibid). This means that a significant level of conflict between various water based recreational activities probably does not occur on Kerr Lake. However, this situation could change if further development were to occur. It was previously estimated that Kerr Lake could accommodate an additional 33 cottage equivalent units without detectably affecting water quality (Section 3.4). Assuming that the entire 33 unit capacity were composed of cottages, the additional maximum instantaneous boat use would approximate 5 boats (per Equation 6). This is still well within the estimated lake capacity. However, if the entire 33 cottage equivalent units were comprised of campsites and day use sites (i.e. 142 sites)\*, the additional maximum instantaneous boat use would approximate 57 boats (per Equation 6). This would constitute considerable overcrowding of the lake. Assuming that future developments do not include any residences or cottages, Kerr Lake could accommodate a maximum of only 30 additional campsites/day use sites from the standpoint of boating safety (per Equation 6). (Capacity minus current use equals 12 boats.) Since future developments are likely to involve a combination of uses, proponents must be careful not to exceed the boat capacity for the lake. The ratio of additional cottage equivalent units permitted (i.e. 33 units) to the number of

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\* Where 4.3 campsites/day use sites are equivalent to one cottage.

additional campsites/day use sites (i.e. 30 sites) equals 1.1. Therefore, it is recommended that the campsites/day use sites are factored at a rate 1.1 when compared to cottages for purposes of evaluating future development proposals. This means that boating safety considerations (factor of 1.1) must be assigned a greater priority than the maximum number of sites which could be permitted from a phosphorus loading viewpoint (a factor of 4.3).

Current boating use of Otter Lake was estimated at 37% of capacity (Table 28). This suggested that there was no appreciable level of conflict between various water based recreational activities on the lake.

Current boating use of Little Jackfish Lake was estimated at 8% of capacity (Table 28). This light rate of use indicated that conflicts between various water based recreational activities should not occur on the lake at the present level of development.

It was estimated that up to 77 boats may operate safely on Sandy Lake at any one time (Table 28). Current boating use was moderately heavy and approximated 57% of capacity (Ibid). Again, significant conflicts between various water based recreational activities were considered unlikely under present use patterns.

It was estimated that current boating use of Crawford Lake approximated 50% of capacity (Table 28). This moderately heavy rate of use suggested that significant conflict probably does not occur between various water based recreational activities at present. However, like Kerr Lake, this situation could change if the potential for permissible future development were not to follow certain

patterns. It was estimated that Crawford Lake could accommodate a further 19 cottage equivalent units without detectably affecting water quality (Section 3.4). Assuming that the entire 19 unit capacity were composed of cottages, the additional maximum instantaneous boat use would approximate 3 boats (per Equation 6). This is still within the estimated lake capacity. However, assuming that the entire available boating space (5 boats) was allocated to campsites/day use sites, only 13 additional sites could be safely permitted (per Equation 6). Therefore, proponents of future developments must be careful not to exceed the boat capacity for the lake. The ratio of additional permissible cottage equivalent units (i.e. 19 units) to the number of additional campsites/day use sites which may be safely permitted (i.e. 13 sites) was 1.46. Therefore, it is recommended that the campsites/day use sites are factored at a rate of 1.46 when compared to cottages for the purpose of evaluating future development proposals. Again, this means that boating safety considerations require a lesser degree of campsite/day use site development than might ordinarily be permitted from the standpoint of maintenance of water quality (phosphorus loading).

Current boating use of Thomas Lake was estimated at 68% of capacity (Table 28). Assuming that pertinent recommendations of the present study (Section 3.4) are adopted and that further development at Thomas Lake is not permitted, the present and anticipated future rate of fairly heavy utilization does not pose a significant concern with respect to boating safety considerations. This was consistent with Brown and Beck (1980).

Current boating utilization of Czornyj Lake is estimated at 33% of capacity (Table 28). Like Kerr and Crawford lakes, Czornyj Lake could become crowded with boats if permissible future development is not carefully guided. It was estimated that Czornyj Lake could accommodate a further 11 cottage equivalent units without detectably affecting water quality (Section 3.4). Assuming that the entire 11 unit capacity was devoted to cottages, the additional maximum instantaneous boat use would approximate 2 boats (per Equation 6). This is well within the estimated boat capacity. Assuming that the entire available boat space (4 boats) was allocated to campsites/day use sites, only 10 additional sites could be safely permitted (per Equation 6). The ratio of additional permissible cottage equivalent units (i.e. 11 units) to the number of additional campsites/day use sites which may be safely accommodated (i.e. 10 sites) was 1.1. Therefore, it is recommended that the campsites/day use sites are factored at a rate of 1.1 when compared to cottages for the purpose of evaluating future development proposals.

It was estimated that current boating use of Dummy Lake approximates 5% of capacity (Table 28). This light rate of utilization suggested that conflicts between various water based recreational activities should not occur on the lake at the present level of development.

Imrie Lake was also subject to a light rate of utilization by boaters. Utilization was estimated at 9% of capacity (Table 28). As with several of the previously discussed lakes, Imrie Lake could also become crowded with boats if permissible future development is not carefully guided. It was estimated that Imrie Lake could accommodate

a maximum of 28 further cottage equivalent units without detectably affecting water quality (Section 3.4). Assuming that the entire 28 unit capacity was allocated to cottages, the additional maximum instantaneous boat use would approximate 5 boats (per Equation 6). This remains within the estimated boat capacity for the lake. Assuming that the entire available boat space (10 boats) was allocated to campsites/day use sites, only 25 additional sites could be safely permitted (per Equation 6). The ratio of additional permissible cottage equivalent units (i.e. 28 units) to the number of additional campsites/day use sites which may be safely accommodated (i.e. 25 sites) was 1.12. Therefore, it is recommended that the campsites/day use sites are factored at a rate of 1.12 when compared to cottages for the purpose of evaluating future development proposals.

It was estimated that current boating use of Seech Lake exceeded capacity by approximately 40% (Table 28). This meant that there was a significant potential for a serious boating accident to occur. Additionally, there was probably a significant level of non contact interferences between the various water based recreational activities. Therefore, some action should be taken to reduce the potential for these conflicts. At least two approaches can be considered for the resolution of this problem. The first considers a reduction in the present campsite/day use site availability (50 sites). Because lake boat capacity was exceeded by an estimated 6 boats (Table 28), a minimum of 15 sites (per Equation 6) would have to be eliminated. This course of action not only may be unacceptable to the parties concerned, but also additional cottages could not be

accommodated near the lake. An alternate approach considers restrictions on motorized boats. Assuming that all motors were prohibited from use on Seech Lake, the present level of access to campsites/day use sites need not be curtailed. Additionally, the previously estimated maximum recommended future development potential of 26 cottage equivalent units (Section 3.4) could be accommodated as well. Because the mandate of the present study may be interpreted as determining the maximum amount of development which may ecologically and safely be permitted, it is recommended that local authorities consider prohibiting the use of motorized craft on Seech Lake.

Current boat utilization of Stewart Lake was estimated at 15% of capacity (Table 28). This light to moderate rate of utilization was perceived to result in no significant level of conflicts between various water based recreational activities.

#### 4.0 CONCLUSIONS

The nature of the present study yielded a variety of conclusions about each of the lakes investigated. Given the singular interests of the majority of intended readers, the conclusions have been organized on an individual lake basis.

##### Ditch (Gertrude) Lake:

It was concluded that:

- a) Ditch Lake is an eutrophic waterbody;
- b) the water quality generally is suitable for recreational purposes except during major blue-green algae (Cyanophyte) blooms;
- c) water quality conditions will continue to deteriorate over time unless ameliorative action is taken;
- d) phosphorus is the limiting nutrient which controls algae and macrophyte growth in Ditch Lake;
- e) a valid phosphorus budget was developed for predictive purposes;
- f) the rate of phosphorus loading was excessive;
- g) the development capacity of Ditch Lake has been exceeded by approximately 500%;
- h) the boating capacity of Ditch Lake has been exceeded by approximately 325%;
- i) the potential for both a serious boating accident to occur and a high level of conflict between various water based recreational activities is significant.

Kerr Lake:

It was concluded that:

- a) Kerr Lake is a borderline eutrophic waterbody;
- b) the water quality generally is suitable for recreational purposes except during particularly severe blue-green algae (Cyanophyte) blooms;
- c) water quality conditions will continue to slowly deteriorate over time unless ameliorative action is taken;
- d) phosphorus is the limiting nutrient which controls algae and macrophyte growth in Kerr Lake;
- e) a valid phosphorus budget was developed for predictive purposes;
- f) the rate of background phosphorus loading was excessive;
- g) Kerr Lake can accommodate an estimated maximum of 55 cottage equivalent units of development without inducing detectable water quality deterioration;
- h) the present degree of development at Kerr Lake approximates 22 cottage equivalent units;
- i) an estimated maximum of 33 additional cottage equivalent units may be accommodated at Kerr Lake without inducing detectable water quality deterioration;
- j) cottage equivalent units for Kerr Lake may be calculated at the rate of 1 cottage = 0.147 residences = 1.10 campsites/day use sites;
- k) current boating use of Kerr Lake is moderately heavy but within the capacity for the lake;

- 1) significant conflicts between various water based recreational activities are unlikely assuming that the development capacity of the lake is not exceeded.

Otter Lake:

It was concluded that:

- a) Otter Lake is a highly eutrophic waterbody;
- b) the water quality generally is not considered suitable for many recreational purposes;
- c) either nitrogen or phosphorus may limit algae and macrophyte growth in Otter Lake;
- d) the body of physicochemical data obtained was insufficient for the evaluation of development capacity;
- d) significant conflicts between various water based recreational activities are unlikely at present moderate rates of utilization of Otter Lake.

Little Jackfish Lake:

It was concluded that:

- a) Little Jackfish Lake is a highly eutrophic waterbody;
- b) the water quality generally is not considered suitable for many recreational purposes;
- c) nitrogen is the limiting nutrient which controls algae and macrophyte growth in Little Jackfish Lake;

- d) the body of physicochemical data obtained was insufficient for the evaluation of development capacity;
- e) significant conflicts between various water based recreational activities are unlikely at present light rates of utilization of Little Jackfish Lake.

Sandy Lake:

It was concluded that:

- a) Sandy Lake is an eutrophic waterbody;
- b) the water quality generally is suitable for recreational purposes except during major blue-green algae (Cyanophyte) blooms;
- c) phosphorus is the limiting nutrient which controls algae and macrophyte growth in Sandy Lake;
- d) the body of physicochemical data obtained was insufficient for the evaluation of development capacity;
- e) significant conflicts between various water based recreational activities are unlikely at the present moderately heavy rates of utilization of Sandy Lake.

Crawford (St. Dalmas) Lake:

It was concluded that:

- a) Crawford Lake is a mesotrophic waterbody;
- b) the water quality is suitable for recreational purposes;

- c) water quality conditions will continue to deteriorate over time unless ameliorative action is taken;
- d) either nitrogen or phosphorus may limit algae and macrophyte growth in Crawford Lake;
- e) a valid phosphorus budget was developed for predictive purposes;
- f) the rate of background phosphorus loading was excessive even in comparison to other lakes of the present study;
- g) Crawford Lake can accommodate an estimated maximum of 25 cottage equivalent units without inducing detectable water quality deterioration;
- h) the present degree of development at Crawford Lake approximates 6 cottage equivalent units;
- i) an estimated maximum of 19 additional cottage equivalent units may be accommodated at Crawford Lake without inducing detectable water quality deterioration;
- j) cottage equivalent units for Crawford Lake may be calculated at the rate of 1 cottage = 0.147 residences = 1.46 campsites/day use sites;
- k) current boating use of Crawford Lake is moderately heavy but still within capacity for the lake;
- l) significant conflicts between various water based recreational activities are unlikely assuming that the development capacity of the lake is not exceeded.

Thomas Lake:

It was concluded that:

- a) Thomas Lake is a mesotrophic waterbody;
- b) the water quality is suitable for recreational purposes;
- c) water quality conditions will continue to slowly deteriorate over time unless ameliorative action is taken;
- d) either nitrogen or phosphorus may limit algae and macrophyte growth in Thomas Lake;
- e) a valid phosphorus budget was developed for predictive purposes;
- f) the rate of background phosphorus loading was excessive;
- g) Thomas Lake can accommodate an estimated maximum of 108 cottage equivalent units without inducing detectable water quality deterioration;
- h) the present degree of development at Thomas Lake approximates 102 cottage equivalent units;
- i) further development at Thomas Lake would accelerate water quality deterioration;
- j) current boating use of Thomas Lake is fairly heavy but still within capacity for the lake;
- k) significant conflicts between various water based recreational activities are unlikely assuming that further development of Thomas Lake does not occur.

Czornyj (Horod) Lake:

It was concluded that:

- a) Czornyj Lake is an eutrophic waterbody;
- b) the water quality generally is suitable for recreational purposes except during major blue-green algae (Cyanophyte) blooms;
- c) water quality conditions will continue to deteriorate over time unless ameliorative action is taken;
- d) phosphorus is the limiting nutrient which controls algae and macrophyte growth in Czornyj Lake;
- e) a valid phosphorus budget was developed for predictive purpose;
- f) the rate of background phosphorus loading was excessive;
- g) Czornyj Lake can accommodate an estimated maximum of 14 cottage equivalent units of development without inducing detectable water quality deterioration;
- h) the present degree of development at Czornyj Lake approximates 3 cottage equivalent units;
- i) an estimated maximum of 11 additional cottage equivalent units may be accommodated at Czornyj Lake without inducing detectable water quality deterioration;
- j) cottage equivalent units for Czornyj Lake may be calculated at the rate of 1 cottage = 0.147 residences = 1.10 campsites/day use sites;
- k) current boating use of Czornyj Lake is moderate and within capacity for the lake;

- 1) significant conflicts between various water based recreational activities are unlikely assuming that the development capacity of the lake is not exceeded.

Dummy (Blue) Lake:

It has been concluded that:

- a) Dummy Lake is a borderline eutrophic waterbody;
- b) the water quality generally is suitable for recreational purposes except during particularly severe blue-green algae (Cyanophyte) blooms;
- c) either nitrogen or phosphorus may limit algae and macrophyte growth in Dummy Lake;
- d) the body of physicochemical data obtained was insufficient for the evaluation of development capacity;
- e) significant conflicts between various water based recreational activities are unlikely at present light rates of utilization of Dummy Lake.

Imrie Lake:

It has been concluded that:

- a) Imrie Lake is a borderline eutrophic waterbody;
- b) the water quality generally is suitable for recreational purposes except during particularly severe blue-green algae (Cyanophyte) blooms;

- c) water quality conditions will remain relatively stable unless uncontrolled land surface disruption occurs within the immediate watershed;
- d) phosphorus is the limiting nutrient which controls algae and macrophyte growth in Imrie Lake;
- e) a valid phosphorus budget was developed for predictive purposes;
- f) the rate of background phosphorus loading was on the verge of becoming excessive;
- g) Imrie Lake can accommodate an estimated maximum of 29 cottage equivalent units without inducing detectable water quality deterioration.
- h) the present degree of development at Imrie Lake approximates 1 cottage equivalent unit;
- i) an estimated maximum of 28 additional cottage equivalent units may be accommodated at Imrie Lake without inducing detectable water quality deterioration, providing that land surface disruption is minimal;
- j) cottage equivalent units for Imrie Lake may be calculated at the rate of 1 cottage = 0.147 residences = 1.12 campsites/day use sites;
- k) current boat utilization of Imrie Lake is light and well within lake capacity;
- l) significant conflicts between various water based recreational activities are unlikely assuming that the development capacity of the lake is not exceeded.

Seech Lake:

It was concluded that:

- a) Seech Lake is a mesotrophic waterbody;
- b) the water quality is suitable for recreational purposes;
- c) water quality conditions will continue to slowly deteriorate over time unless ameliorative action is taken;
- d) either nitrogen or phosphorus may limit algae and macrophyte growth in Seech Lake;
- e) a valid phosphorus budget was developed for predictive purposes;
- f) the rate of background phosphorus loading was excessive;
- g) Seech Lake can accommodate an estimated maximum of 32 cottage equivalent units without inducing detectable water quality deterioration;
- h) the present degree of development at Seech Lake approximates 6 cottage equivalent units;
- i) an estimated maximum of 26 additional cottage equivalent units may be accommodated at Seech Lake without inducing detectable water quality deterioration;
- j) cottage equivalent units for Seech Lake may be calculated at the rate of 1 cottage = 0.147 residences = 0 campsites/day use sites;
- k) current boat utilization of Seech Lake approximates 140% of capacity;

- 1) the potential for both a serious boating accident to occur and a high level of conflict between various water based recreational activities is significant.

Stewart Lake:

It was concluded that:

- a) Stewart Lake is a borderline eutrophic waterbody;
- b) the water quality generally is suitable for recreational purposes except during particularly severe blue-green algae (Cyanophyte) blooms;
- c) either nitrogen or phosphorus may limit algae and macrophyte growth in Stewart Lake;
- d) the body of physicochemical data obtained was insufficient for the evaluation of development capacity;
- e) significant conflicts between various water based recreational activities are unlikely at present light to moderate rates of utilization of Stewart Lake.

## 5.0 RECOMMENDATIONS

Given the singular interests of the majority of intended readers, the recommendations have been organized on an individual lake basis.

### Ditch (Gertrude Lake):

It is recommended that:

- a) further development of Ditch Lake not be permitted;
- b) recreationers and local landowners undertake water quality enhancement measures such as the installation of wastewater holding tanks at all cottages, campgrounds and day use facilities and the planting of tree and shrub buffer zones around areas of shoreline that are currently devoid of this vegetation;
- c) local authorities consider imposing restrictions upon power boats operating on Ditch Lake.

### Kerr Lake:

It is recommended that:

- a) future development at Kerr Lake not exceed a lake total of 33 additional cottage equivalent units;
- b) cottage equivalent units for Kerr Lake be calculated at the rate of 1 cottage = 0.147 residences = 1.10 campsites/day use sites.

Otter Lake:

It is recommended that:

- a) the limnological study of Otter Lake be extended for another year in an attempt to develop sound indices of development capacity for the lake;
- b) approval of development proposals for the lake be postponed until completion and interpretation of the extended limnological study.

Little Jackfish Lake:

It is recommended that:

- a) the limnological study of Little Jackfish Lake be extended for another year in an attempt to develop sound indices of development capacity for the lake;
- b) approval of development proposals for the lake be postponed until completion and interpretation of the extended limnological study.

Sandy Lake:

It is recommended that:

- a) the limnological study of Sandy Lake be extended for another year in an attempt to develop sound indices of development capacity for the lake;
- b) approval of development proposals for the lake be postponed until completion and interpretation of the extended limnological study.

Crawford (St. Dalmas) Lake:

It is recommended that:

- a) future development at Crawford Lake not exceed a lake total of 19 additional cottage equivalent units;

- b) cottage equivalent units for Crawford Lake be calculated at the rate of 1 cottage = 0.147 residences = 1.46 campsites/day use sites;
- c) local landowners and recreationers be encouraged to establish tree and shrub buffer zones around currently exposed areas of the shoreline.

Thomas Lake:

It is recommended that further development at Thomas Lake not be permitted.

Czornyj (Horod) Lake:

It is recommended that:

- a) future development at Czornyj Lake not exceed a lake total of 11 additional cottage equivalent units;
- b) cottage equivalent units for Czornyj Lake be calculated at the rate of 1 cottage = 0.147 residences = 1.10 campsites/day use sites.

Dummy (Blue) Lake:

It is recommended that:

- a) the limnological study of Dummy Lake be extended for another year in an attempt to develop sound indices of development capacity for the lake;
- b) approval of development proposals for the lake be postponed until completion and interpretation of the extended limnological study.

Imrie Lake:

It is recommended that:

- a) future development at Imrie Lake not exceed a lake total of 28 additional cottage equivalent units;
- b) proponents of all future developments exercise extreme care to keep land surface disruption to a minimum;
- c) cottage equivalent units for Imrie Lake be calculated at the rate of 1 cottage - 0.147 residences = 1.12 campsites/day use sites.

Seech Lake:

It is recommended that:

- a) future development at Seech Lake not exceed a lake total of 26 additional cottage equivalent units;
- b) cottage equivalent units for Seech Lake be calculated at the rate of 1 cottage = 0.147 residences = 0 campsites/day use sites;
- c) local authorities consider prohibiting the use of motorized craft on Seech Lake.

Stewart Lake:

It is recommended that:

- a) the limnological study of Stewart Lake be extended for another year in an attempt to develop sound indices of development capacity for the lake;
- b) approval of development proposals for the lake be postponed until completion and interpretation of the extended limnological study.

#### 6.0 ACKNOWLEDGEMENTS

Credit for the impetus resulting in the present study properly belongs to the South Riding Mountain Planning District Board. The foresight, concern and attention of the Board Members is gratefully acknowledged. Mr. Wally Dmyterko, Secretary-Treasurer to the Board, played several key roles in the project. His detailed knowledge of the study area, command of local development facts and supervision of field staff were instrumental to the success of the project. Particular appreciation must also be expressed to Mr. Bob Philipation and Ms. Sherri Dmyterko, whose labors were essential to project completion. Bob and Sherri conducted the field work in a diligent and conscientious manner and their efforts are greatly appreciated. The contour figures of nine lakes that were provided by Mr. Brian Yake (Western Region Fisheries Branch) are also acknowledged. We are indebted to staff of the W. M. Ward Technical Services Laboratory for sample analysis. Term funding for summer staff was provided by the "Career Start '85" program. Summer field operational expenses were covered by the South Riding Mountain Planning District.

## 7.0 REFERENCES CITED

- Barica, J. 1977. Effect of Freeze-up on Major Ion and Nutrient Content of a Prairie Winterkill Lake. J. Fish. Res. Board. Can. 34:2210-2215.
- Barica, J., H. Kling and J. Gibson. 1978. Chlorophyll a, Nutrients and Dissolved Oxygen in Eight Small Lakes near Erickson, Southwestern Manitoba, 1974-1977 data. Can. Fish. Mar. Serv. Data Rep. 94:15 pp.
- Brandes, M., N. A. Chowdry and W. W. Cheng. 1974. Experimental Study on Removal of Pollutants from Domestic Sewage by Underdrained Soil Filters. National Home Sewage Disposal Symposium, Am. Soc. Agric. Eng., Chicago, Illinois, 1974. Tables reproduced in Hough, Stansbury & Michalski Limited, 1980.
- Brown, D. J., and A. E. Beck. 1980. A Report on the Water Quality of North Thomas Lake. Environmental Standards and Studies Section, Environmental Management Division. Manitoba Department of Consumer and Corporate Affairs and Environment. Winnipeg. 16 pp.
- Carlson, R. E. 1977. A trophic State Index for Lakes. Limnol. Oceanogr. 22:361-369.
- Cassie, R. M. 1971. Sampling and Statistics. IN: A Manual on Methods for the Assessment of Secondary Productivity in Fresh Waters. IBP Handbook No. 17. Edited by W. T. Edmondson and G. G. Winberg. Blackwell Scientific Publications. Oxford, England. pp 174-209.
- Cowen, W. F. and G. F. Lee. 1976. Phosphorus Availability in Particulate Materials Transported in Urban Runoff. Jour. Water Poll. Control Fed. 48:580-591.
- Cowen, W. F., K. Sirishinha and G. F. Lee. 1976. Nitrogen Availability in Urban Runoff. Jour. Water Poll. Control Fed. 48:339-345.
- Dillon, P. J. and W. B. Kirchner. 1975. The Effects of Geology and Land use on the Export of Phosphorus from Watersheds. Water Res. 9:135-148.
- Dillon, P. J. and F. H. Rigler. 1974. The Phosphorus-Chlorophyll Relationship in Lakes. Limnol. Oceanogr. 19:767-773.
- El-Shaarawi, A. H. and M. A. Neilson. 1984. Changes in Nutrient Levels of Lake Water Stored at 4°C. Can. J. Fish. Aquat. Sci. 41:985-988.

- Gray, D. M. (ed.) 1970. Handbook on the Principles of Hydrology. National Research Council of Canada. Water Information Centre, Inc. Port Washington, N. Y.
- Hough, Stansbury & Michalski Limited. 1980. An Evaluation of Methods to Assess the Effects of Shoreline Development on Lake Trophic State. Prepared for Ontario Ministry of Natural Resources, March 1980. Hough, Stansbury and Michalski Limited. Rexdale, Ontario., 123 pp & app.
- Hutchinson, G. E. 1957. A Treatise on Limnology. Vol. I. Geography, Physics and Chemistry. John Wiley and Sons Inc. New York. 1015 pp.
- Jenkins, G. C. 1970. Land Use Study of the South Side Riding Mountain Area. ARDA Project No. 7038. Canada Land Inventory Project. Manitoba Department of Mines and Natural Resources. 93 pp. 14 maps.
- Manitoba Natural Resources. 1985. Manitoba Park Statistics. 1984. Parks Branch, Manitoba Natural Resources. Winnipeg. 308 pp.
- Municipal Affairs. 1985. Municipal Officials Manitoba 1985. Advisory and Financial Services Branch. Manitoba Department of Municipal Affairs. Winnipeg. 68 pp.
- Piwoni, M. D. and G. F. Lee. 1975. Report on Nutrient Load-Eutrophication Response of Selected South-Central Wisconsin Impoundments. Report to US EPA, Environmental Research Laboratory. Corvallis, Oregon. 31 pp. IN: Rast and Lee, 1978.
- Rast W., and G. F. Lee. 1978. Summary Analysis of the North American (US Portion) OECD Eutrophication Project: Nutrient Loading-Lake Response Relationships and Trophic State Indices. Corvallis Environmental Research Laboratory, Office of Research and Development. US Environmental Protection Agency. Corvallis, Oregon. 453 pp.
- Redfield, A. C., B. H. Ketchum and F. A. Richards. 1963. The Influence of Organisms on the Composition of Sea Water. IN: M. N. Hill (ed.), The Sea, Vol. 2, Wiley-Interscience. New York. pp 26-77. IN: Rast and Lee, 1978.
- Riley, E. T. and E. E. Prepas. 1985. Comparison of the Phosphorus Chlorophyll Relationships in Mixed and Stratified Lakes. Can. J. Fish. Aquat. Sci. 42:831-835.
- Schindler, D. W. 1977. Evolution of Phosphorus Limitation in Lakes. Science (Wash., D.C.) 195:260-262.

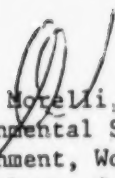
- Schindler, D. W., F. A. J. Armstrong, S. K. Holmgren and G. J. Brunskill. 1971. Eutrophication of Lake 227, Experimental Lakes Area, Northwestern Ontario, by Addition of Phosphate and Nitrate. J. Fish. Res. Board Can. 28:1763-1782.
- Schindler, D. W., R. W. Newbury, K. G. Beatty and P. C. Campbell. 1976. Natural Water and Chemical Budgets for a Small Precambrian Lake in Central Canada. J. Fish. Res. Board Can. 33:2526-2543.
- Schindler, D. W., E. J. Fee and T. Rusczyński. 1978. Phosphorus Input and its Consequences for Phytoplankton Standing Crop and Production in the Experimental Lakes Area and in Similar Lakes. J. Fish. Res. Board Can. 35:190-196.
- Sorba, E. A., D. Fox and P. Douville. 1980. Analytical Methods, 2nd ed. Technical Services Laboratory. Manitoba Department of Mines, Natural Resources and Environmental Management. Winnipeg.
- Thomas, J. C. 1983. Lakescape: Guidelines for the Planning and Design of Lake Oriented Seasonal Home Development in Manitoba. MSc Thesis, University of Manitoba. Winnipeg. 217 pp.
- Vallentyne, J. R. 1974. The Algal Bowl. Department of the Environment, Fisheries and Marine Science. Misc. Special Publication #22. Ottawa. 186 pp.
- Vollenweider, R. A. 1968. The Scientific Basis of Lake and Stream Eutrophication, with Particular Reference to Phosphorus and Nitrogen as Eutrophication Factors. Tech. Rep. OECD, Paris. DAS/CSI 68, 27:1-182.
- Vollenweider, R. A. 1975. Input-Output Models, with Special Reference to the Phosphorus Loading Concept in Limnology. Schweiz. Hydrol. 37:53-84.
- Welch, P. S. 1948. Limnological Methods. The Blakiston Co. Toronto. 381 pp.

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South Riding Mountain Planning District  
Box 189  
Erickson, Man.  
ROJ OPO  
December 19th, 1984

  
Mr. M. Notelli, Chief  
Environmental Standards and Studies  
Environment, Workplace Safety and Health  
Fort Osborne Complex  
139 Tuxedo Boulevard  
Winnipeg, Man.  
R3W 0H6

Dear Sir:

The South Riding Mountain Planning District Board respectfully requests that your Branch conduct a cottage capacity study on Ditch Lake (Gertrude Lake). This lake is located approximately 5 miles north of Erickson in the R. M. of Clanwilliam.

At present, the lake is almost ringed with cottages and there has been preliminary initiatives by various land owners to request further subdivision for more cottage development. Our Development Plan, which has received third reading and is presently before the Provincial Cabinet to receive Order-In-Council, contains policies which allow the Planning Board and member Rural Council to limit cottage development on a lake once the lake is considered to be fully developed. Your analysis of this lake with recommendations respecting future cottage development would provide the Planning Board with the necessary information for it to make decisions on future development and provide recommendations to the Rural Council.

The Planning Board has no preference with regards to method of determining cottage capacity at this time except to indicate that it should consider the environment and recreational safety and aesthetics if possible. The Planning Board is willing to provide you with any land use information that you think is necessary.

This analysis is needed within the next 6 to 12 months. Please consider this project and let us know if your Branch can schedule it sometime in 1985.

Further, if this must be a special project we will eventually need the same type of study for Sandy Lake, Otter, Kerr, Stewart, Bottle, Seech and Dummy Lake (sections 4, 5, 8 and 9, Twp. 19, Rge. 21W). This request may assist you in justifying a major project.

Thank you for your co-operation.

Sincerely,



G. Pederson, Chairman  
South Riding Mountain Planning District



Environment and Workplace  
Safety and Health

Environmental Management

P.O. Box 7  
Building 2  
139 Tuxedo Avenue  
Winnipeg, Manitoba, CANADA  
R3N 0H6

February 19, 1985

Mr. G. Pederson, Chairman,  
South Riding Mountain Planning District Board,  
Box 189,  
ERICKSON, Manitoba  
R0J 0P0

Dear Mr. Pederson:

Thank you for your letter dated December 19, 1984. As you may recall from our subsequent telephone conversation, Mr. Morelli has forwarded your letter to me for response.

Thank you also for the offer to provide land use information. This information is critical to development capacity studies and we will certainly take advantage of the opportunity. I will forward an itemized list of informational needs as soon as our preliminary initiatives proceed a bit further along the path to finalization. We sincerely appreciate the efforts of the Planning Board since we share with you the common goal of trying to ensure that resource development is environmentally sound, safe for recreational activities and aesthetically acceptable.

Unfortunately, we are at the moment under severe fiscal restraint. Staffing and budgetary limitations will not permit Water Standards and Studies Section to directly conduct the development capacity studies that you have requested. However, we have initiated an alternate approach in an attempt to have these worthwhile studies completed. We have submitted an application for funding of this project to the Manitoba Environmental Research Committee (MERC). Should we receive a favourable response to our application, the MERC funds would be used to hire temporary staff. Under the guidance of the Water Standards and Studies Section, the temporary staff would conduct the actual field work and compile the data. Data interpretation and report preparation would then be performed either by or under the close supervision of professional Water Standards and Studies Section staff.

At this early stage, there are of course no guarantees that the MERC application will be approved. Accordingly, it may be prudent to tentatively establish alternate ways and means of completing at least the highest priority study (i.e. Gertrude Lake) before the December 1985 deadline that you have established. Assuming that MERC funds will not be forthcoming, it may be possible for us to adjust our schedule sufficiently so as to permit the essential

Mr. G. Pederson

- 2 -

February 19, 1985

allocation of two staff days to the specialized initial survey of Gertrude Lake. However, approximately 3 hours of lake sampling time (per session) at biweekly intervals would still be required for May through to the end of September. Could the Planning Board tentatively develop some arrangements for the biweekly collection and shipment of samples from Gertrude Lake? If this were possible, Water Standards and Studies Section would provide the sample bottles, containers for shipment, instruction in proper sampling technique and interpretation of information.

Further to the scenario in which MERC funds may not be forthcoming, it would still be desirous to conduct development capacity studies on other lakes within the Planning District. As you will recall, your letter of December 19, 1984 lists several lakes and several others were discussed during our subsequent telephone conversation. These studies could tentatively be scheduled for the 1986 summer season providing that alternate funding (eg. Environment 2000, Heritage Habitat Fund, etc). could be arranged.

Thank you for your patience and cooperation in this matter. I shall look forward to receiving your comments. In the interim period, staff are preparing a comprehensive sampling schedule which could be implemented at short notice. Should you require clarification on any matter, please do not hesitate to call me at telephone number 945-7033.

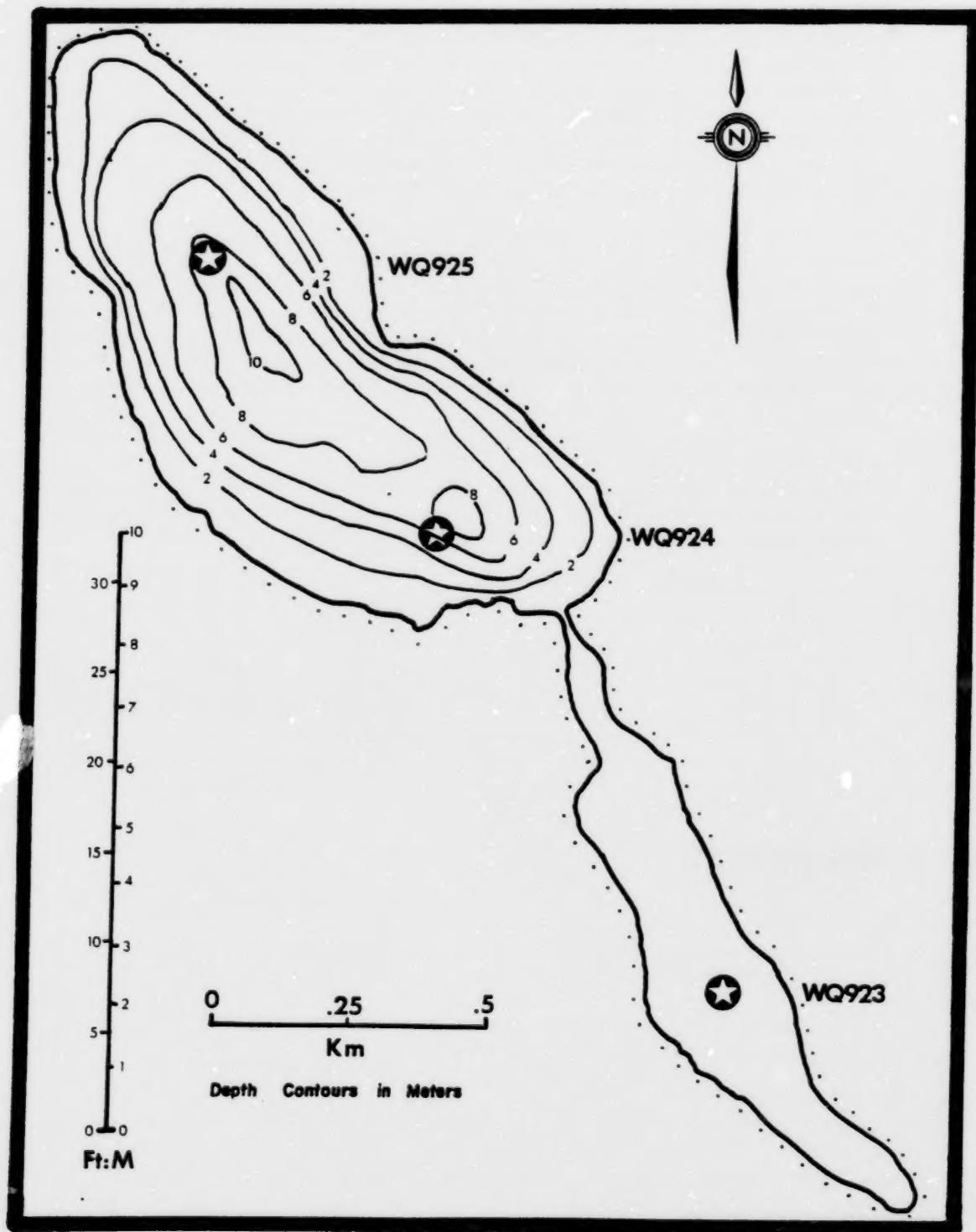
Sincerely,



Dennis Brown, Head,  
Water Standards and Studies.

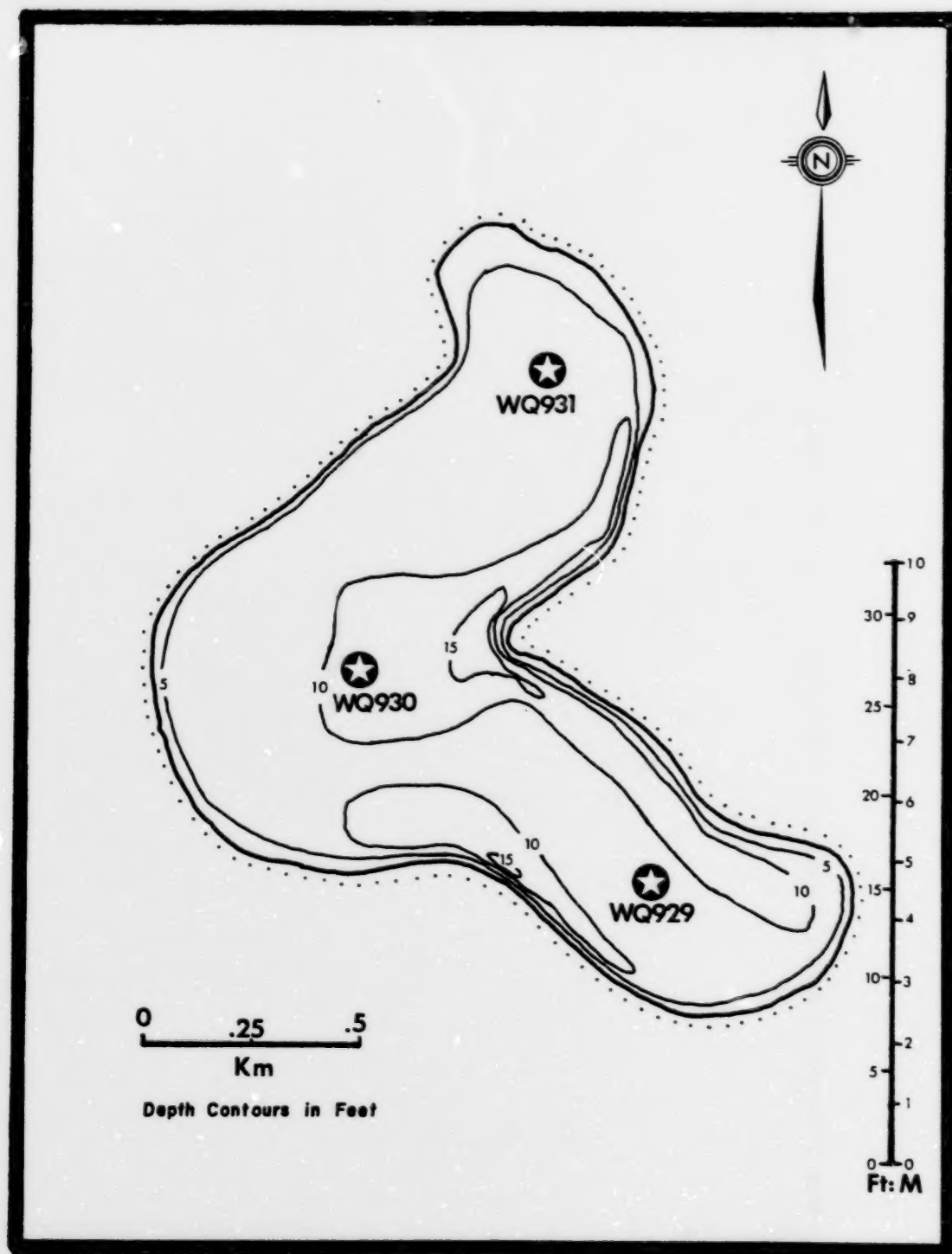
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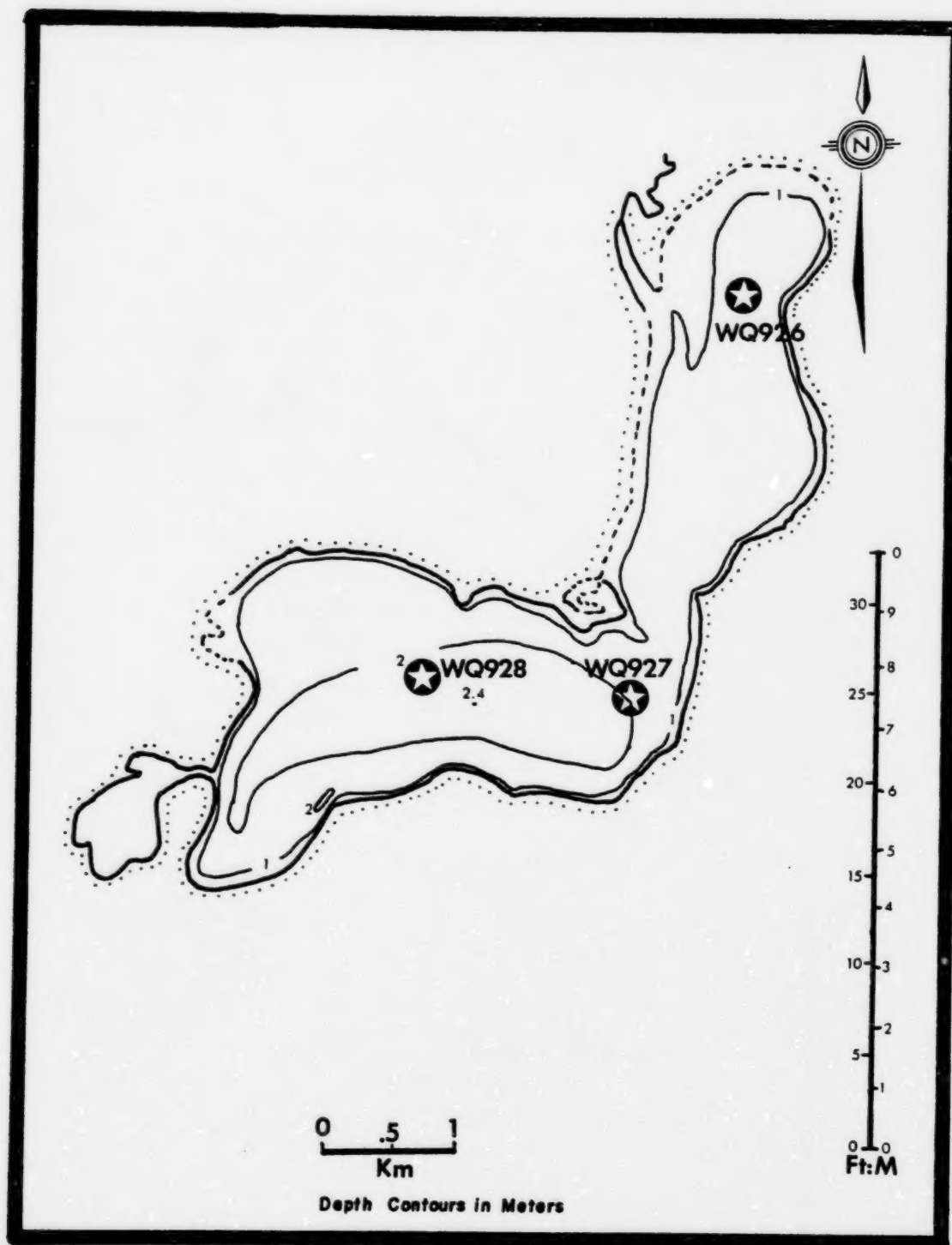
Ditch (Gertrude) Lake contours (m) and sampling stations.

Appendix II(b)



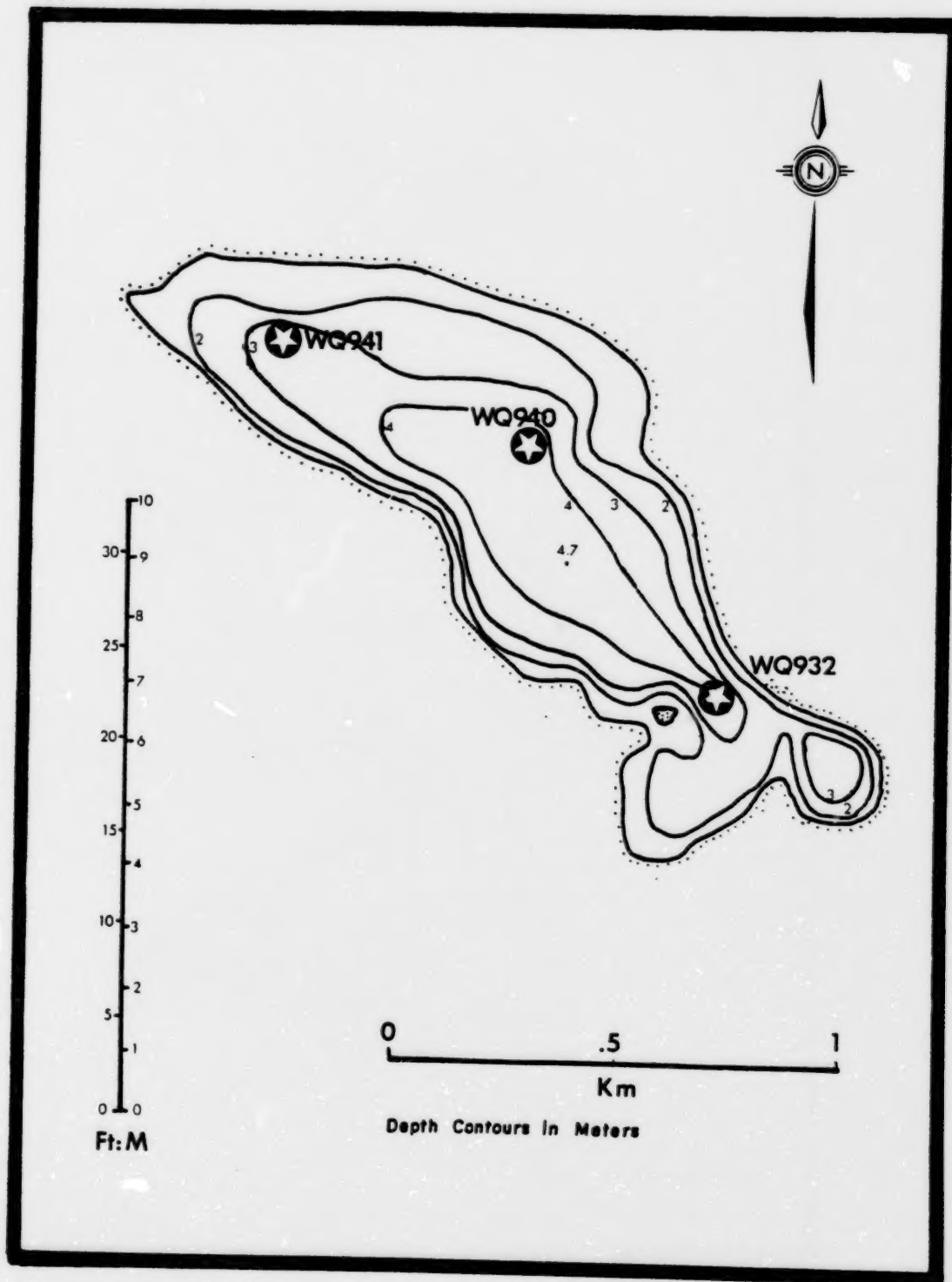
Kerr Lake contours (ft.) and sampling stations.

Appendix II(c)



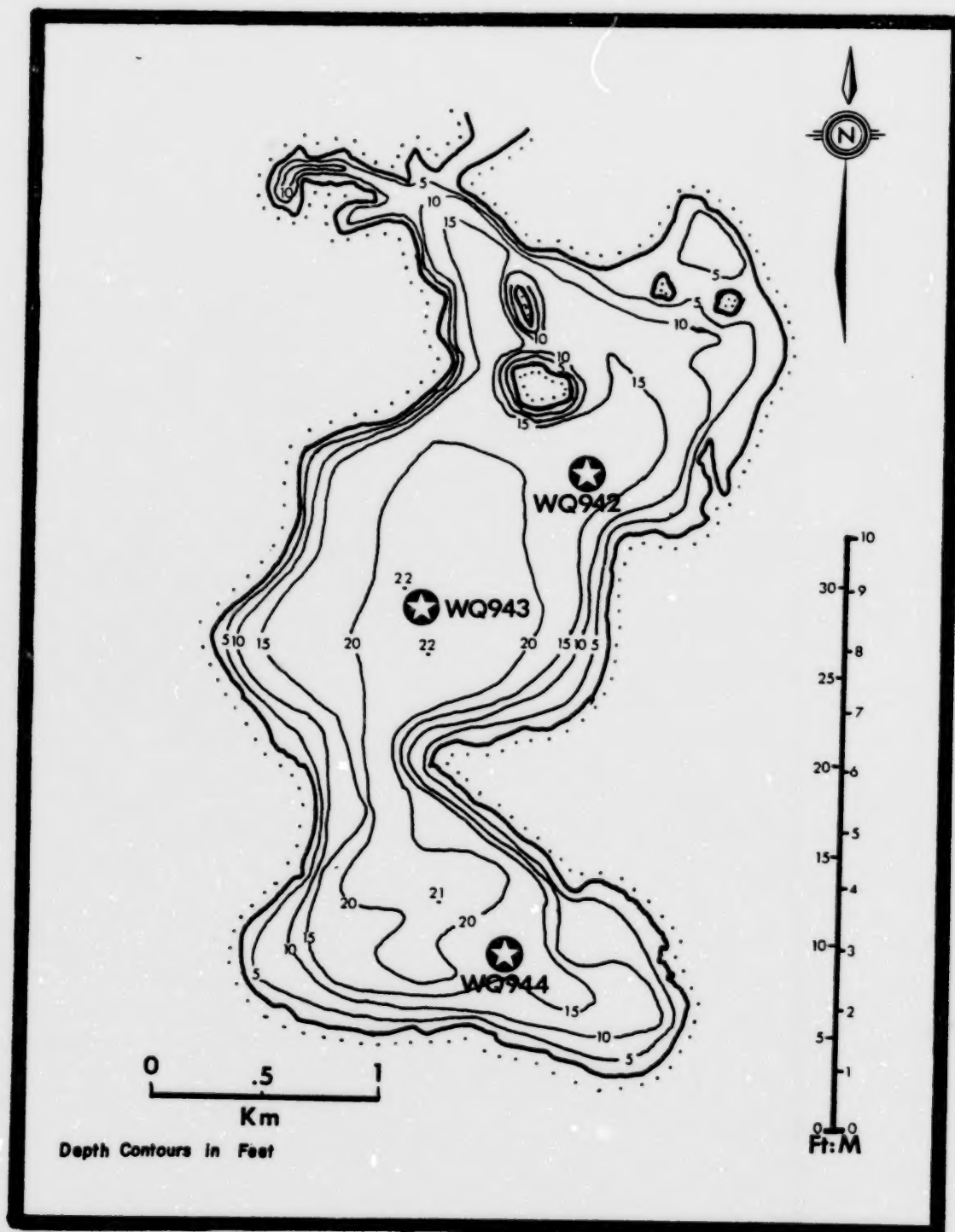
Otter Lake contours (m) and sampling stations.

Appendix II(d)



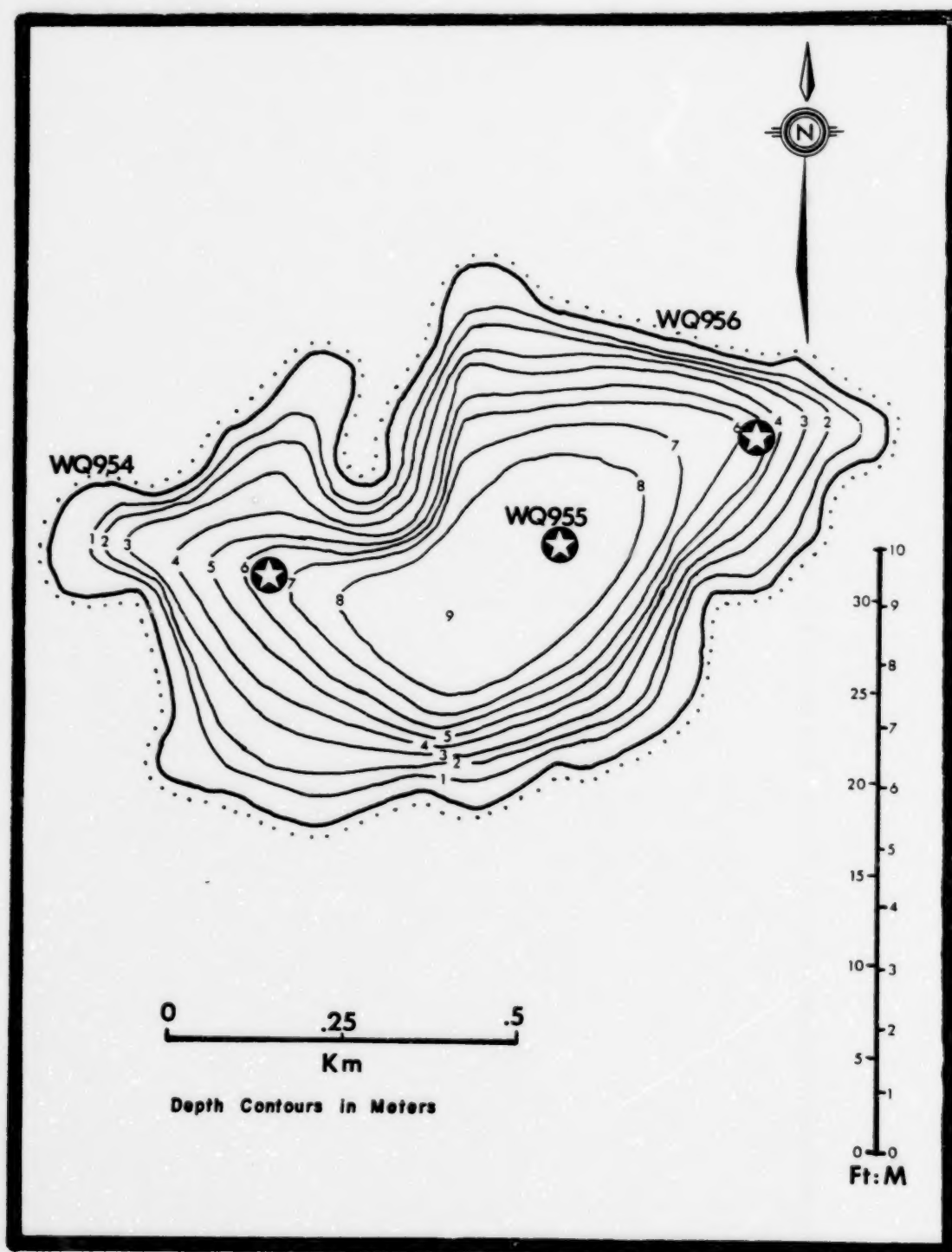
Little Jackfish Lake contours (m) and sampling stations.

Appendix II(e)



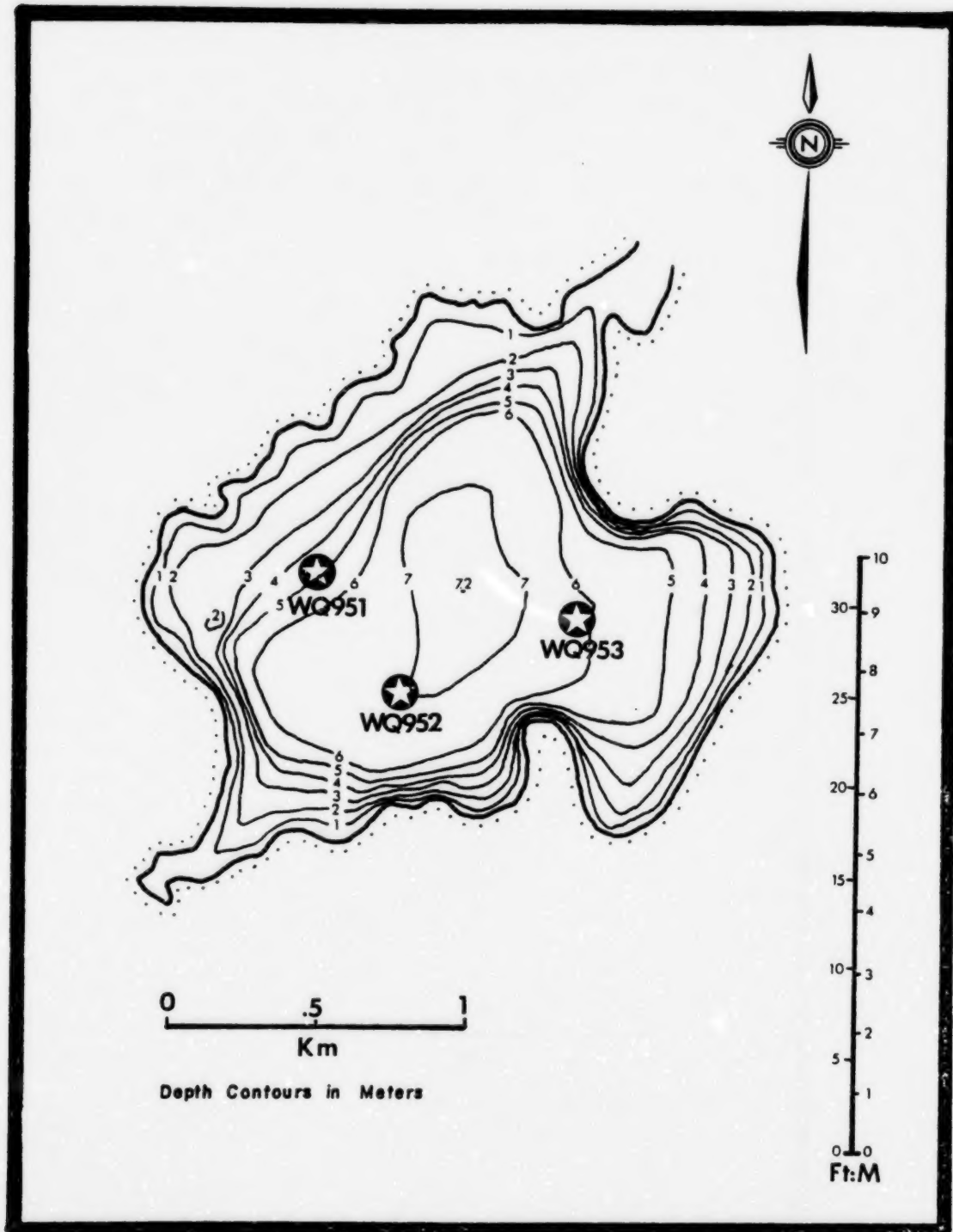
Sandy Lake contours (ft.) and sampling stations.

Appendix II(f)



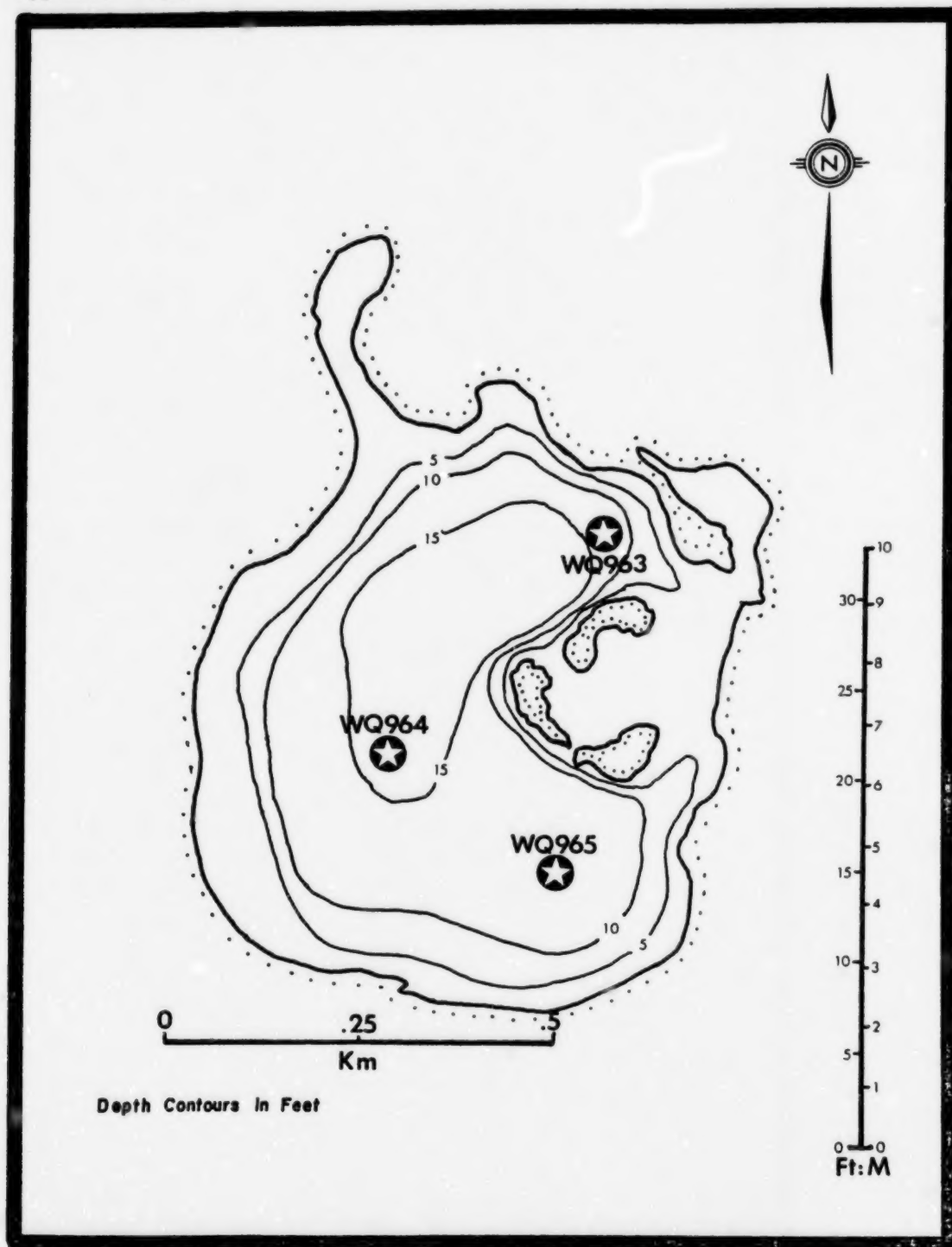
Crawford (St. Dalmas) Lake contours (m) and sampling stations.

Appendix II(g)



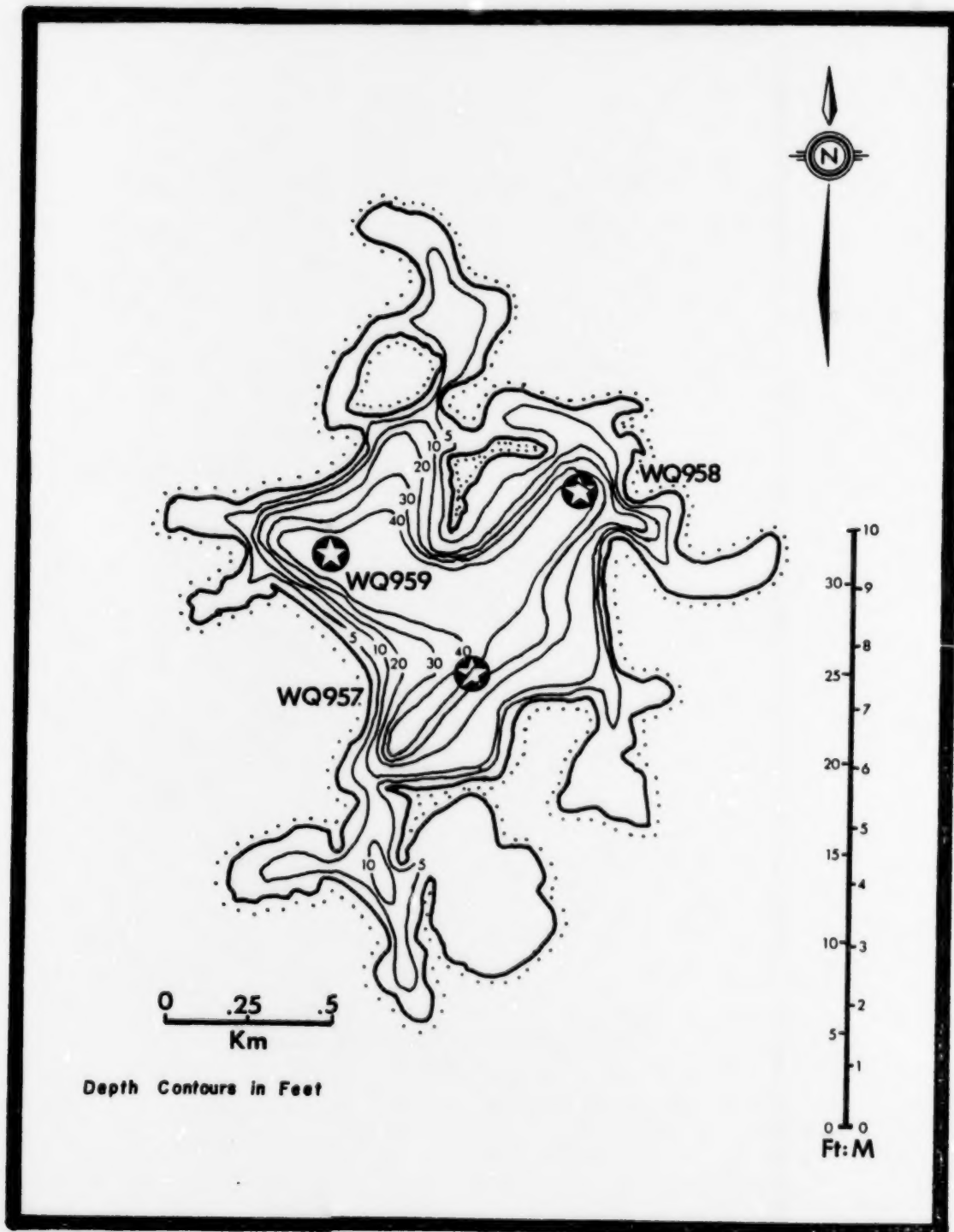
Thomas Lake contours (m) and sampling stations.

Appendix II(h)



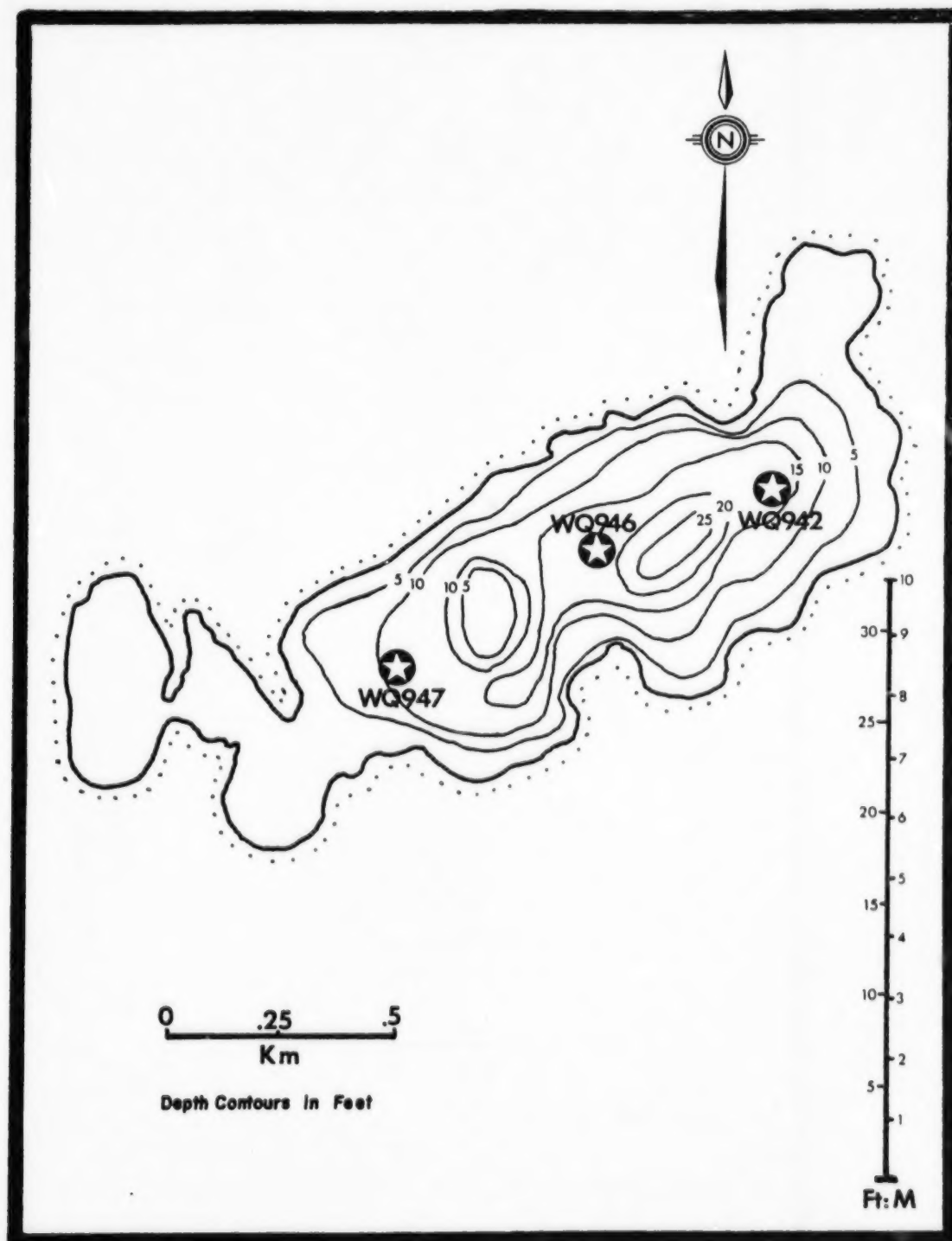
Czornyj (Horod) Lake contours (ft.) and sampling stations.

Appendix II(1)



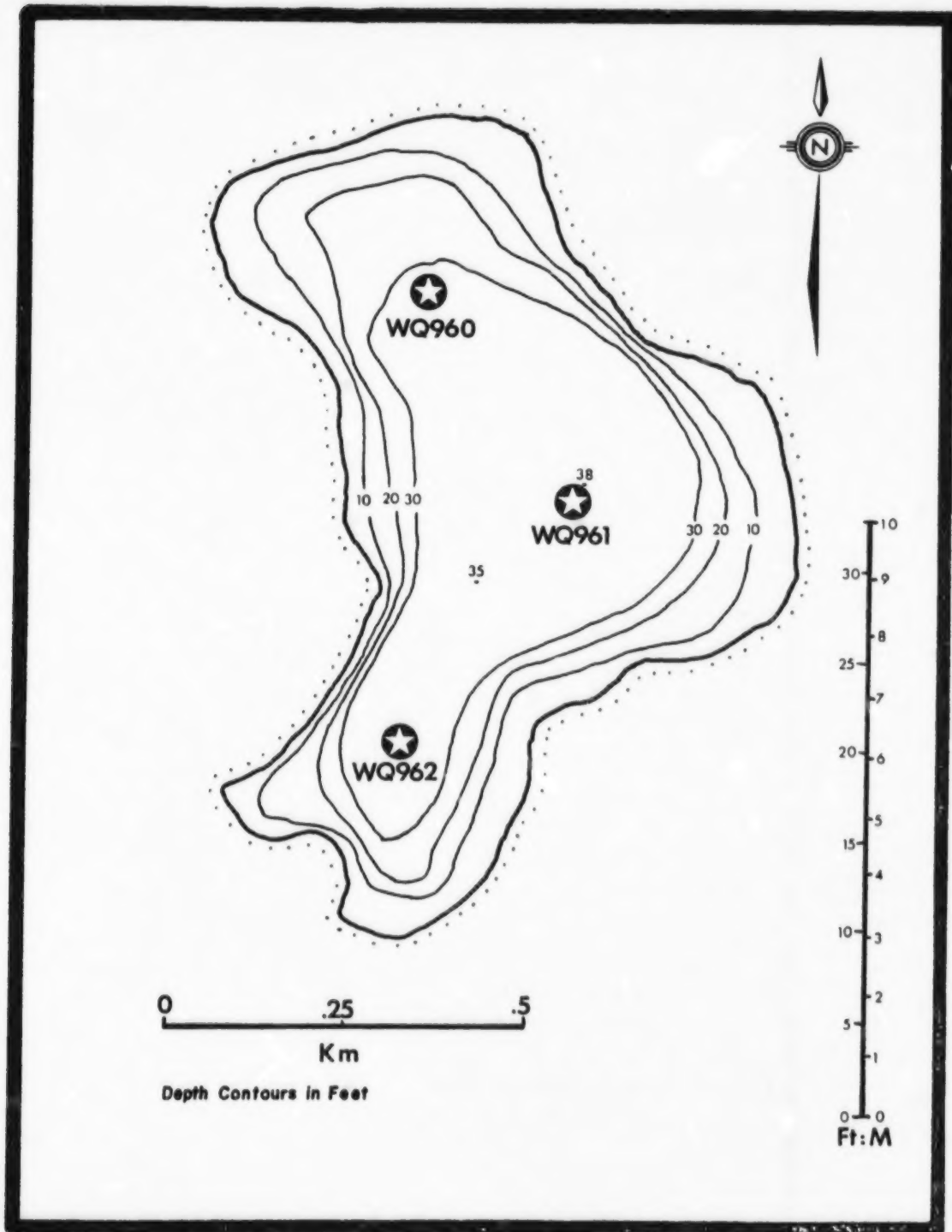
Dummy (Blue) Lake contours (ft.) and sampling stations.

Appendix II(j)



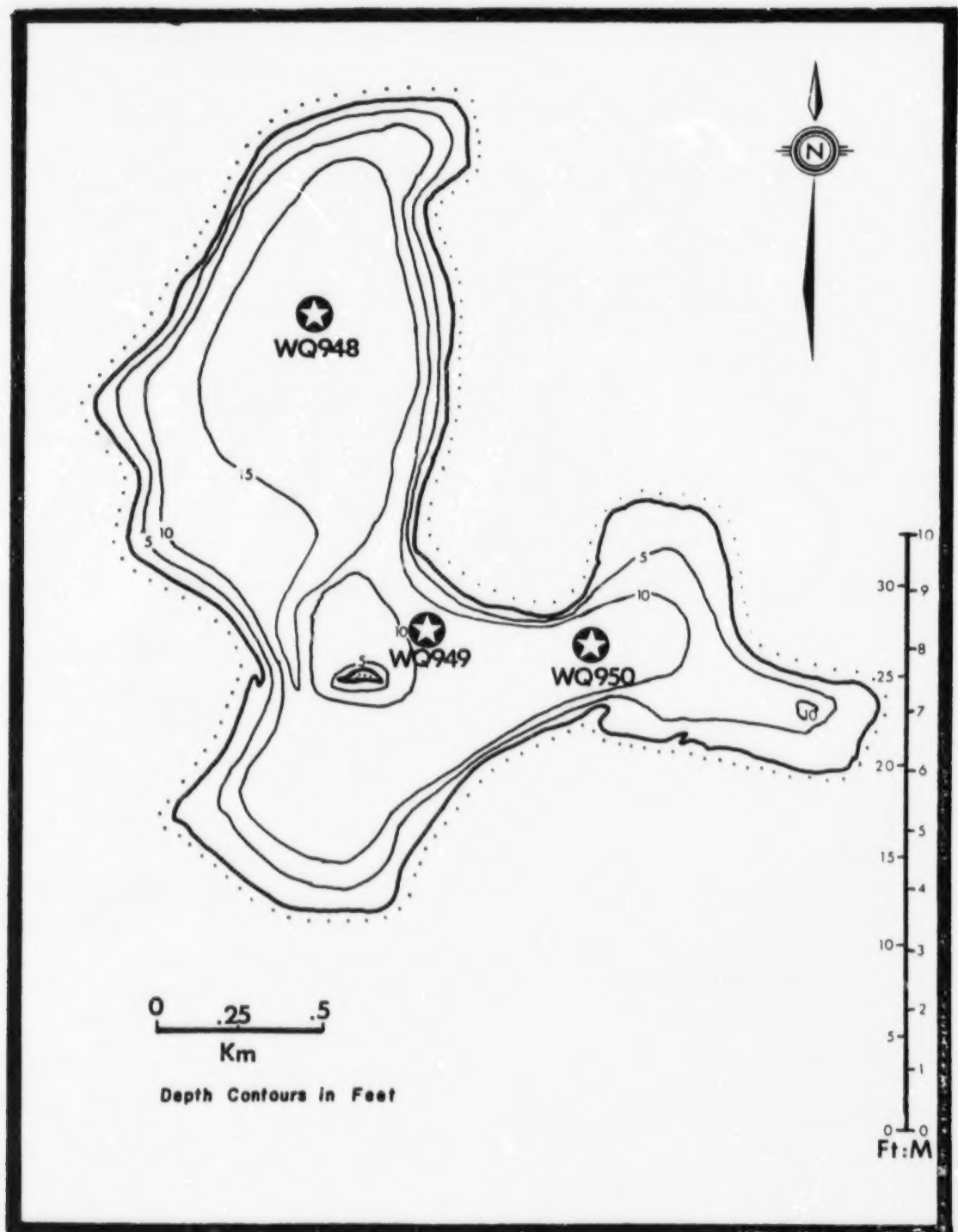
Imrie Lake contours (ft.) and sampling stations.

Appendix II(k)



Seech Lake contours (ft.) and sampling stations.

Appendix II(1)



Stewart Lake contours (ft.) and sampling stations.



## Inter-Departmental Memo

To . Mr. Grant McLeod  
Director of Environmental Control  
Branch  
Environmental Management Division  
139 Tuxedo Avenue

Date January 18, 1980  
From N. Mudry, P.Eng.,  
Director of Planning  
Water Resources Branch  
1577 Dublin Avenue

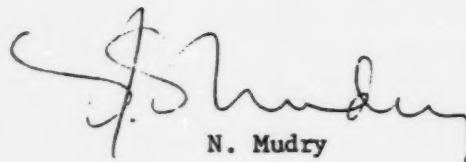
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Telephone

Subject Information on Selected Manitoba Lakes

Further to your memoranda of June 13 and July 24, 1979 requesting information on a number of Manitoba lakes please find the following:

1. An estimate of annual runoff, annual net evaporation over the lake, gross basin drainage area and lake surface area has been prepared for each of the lakes and is summarized in Table 1.
2. Recorded water level information for Thomas, Sharpe and Dromore Lakes.
3. Copies of the maps showing the delineation of the drainage area contributing to each lake will be forwarded when drafting has been completed.

If any questions should arise, please contact Mr. D. Donachuk at 786-9396.

  
N. Mudry

Attachments



TABLE 1

METEOROLOGICAL AND SURFACE AREA INFORMATION

| SUBJECT           | GROSS DRAINAGE<br>AREA IN SQ. KM. | LAKE SURFACE<br>AREA IN SQ. KM. | ANNUAL NET EVAPORATION OVER<br>LAKE IN MILLIMETERS |           |           |                  | ANNUAL RUNOFF<br>IN MILLIMETERS |           |           |                  |
|-------------------|-----------------------------------|---------------------------------|----------------------------------------------------|-----------|-----------|------------------|---------------------------------|-----------|-----------|------------------|
|                   |                                   |                                 | CALCULATED                                         |           | ESTIMATED |                  | CALCULATED                      |           | ESTIMATED |                  |
|                   |                                   |                                 | MEAN                                               | MAX. MIN. | MEAN      | 100 YEAR EXTREME | MEAN                            | MAX. MIN. | MEAN      | 100 YEAR EXTREME |
| 1 THOMAS LAKE     | 23                                | 2                               | -130                                               | 31 -540   | 175       | -550             | 51                              | 102 8     | 203       | 3                |
| 2 PARTRIDGE LAKE  | 4                                 | 0.3                             | -100                                               | 218 -470  | 275       | -525             | 51                              | 89 13     | 191       | 3                |
| 3 SHARPE LAKE     | 43                                | 2                               | -70                                                | 238 -440  | 320       | -500             | 43                              | 76 10     | 165       | 3                |
| 4 DROMORE LAKE    | 56                                | 0.6                             | -85                                                | 228 -455  | 300       | -500             | 46                              | 79 10     | 165       | 3                |
| 5 ECHO LAKE       | 77                                | 9                               | -70                                                | 190 -464  | 300       | -480             | 127                             | 178 25    | 229       | 13               |
| 6 NUMRO LAKE      | 78700                             | 4                               | -70                                                | 190 -464  | 300       | -480             | 211                             | 373 89    | 381       | 76               |
| 7 HORSESHOE LAKE  | 14                                | 4                               | -70                                                | 190 -464  | 300       | -480             | 127                             | 191 25    | 229       | 13               |
| 8 MEDITATION LAKE | 6                                 | 2                               | -70                                                | 190 -464  | 300       | -480             | 127                             | 203 25    | 241       | 13               |
| 9 MUD TURTLE LAKE | 10                                | 2                               | -70                                                | 190 -464  | 300       | -480             | 114                             | 191 25    | 229       | 13               |
| 10 GEORGE LAKE    | 86                                | 13                              | -50                                                | 200 -450  | 325       | -470             | 127                             | 178 25    | 229       | 13               |
| 11 CROWDICK LAKE  | 106                               | 35                              | -41                                                | 219 -440  | 350       | -460             | 127                             | 178 25    | 229       | 13               |

# Manitoba



## Memorandum

Date January 13, 1986

To Al Beck  
Env. Officer  
Water Standards and Studies

From Mark Bennett  
Special Projects Coordinator

Telephone

Subject: YOUR REQUEST FOR INFORMATION/DATA ON DRY DEPOSITION OF PHOSPHORUS

### 1) BACKGROUND

I shall not go into a lot of detail here about dry deposition mechanisms. To be perfectly honest, I cannot claim perfect understanding of the phenomenon. However, basically, the process of deposition (net flux) is defined by the following equation;

$$\text{flux (mass/area/time)} = \text{Aerosol concentration (mass/volume)*} \times \text{deposition velocity (length*/time)}$$

\* the units for length and volume should be the same.

The deposition velocity when calculated involves several variables, including i) Particle or gas

- ii) Physical characteristics (i.e., particle size distribution)
- iii) Chemical characteristics (solubility, reactivity etc)
- iv) Receptor surface characteristics
- v) Meteorological conditions (most importantly wind speed)

On Wednesday, January 8, I spoke to Len Barrie (of Atmospheric Environment Service), who is an expert, and he estimated that the deposition velocity for Phosphate ( $\text{PO}_4$ ) would not be much different than Sulphate ( $\text{SO}_4$ ). Thus, velocities would range from about .1 to 2 cm/sec. Taking particle size distribution into account our best bet would be about .8 cm/sec.

From the data, obtained in Brandon and provided by Don Regehr we find the following;

- i) Range of air phosphate concentrations =  $0.01 - 0.4 \mu\text{g}/\text{m}^3$
- ii) Geometric mean concentration =  $0.02 \mu\text{g}/\text{m}^3$  ( $n=18$ )

NOTE: The distribution of air-borne particulate concentrations is log-normal and, therefore, a geometric mean as opposed to an arithmetic mean, is calculated.

- iii) Sampling took place between June 6 - October 4, 1985 and thus occurred during the open-water season.

Al Beck  
Page 2  
January 13, 1986

2) PREDICTED DEPOSITION LEVELS

The following values represent the predicted dry deposition amounts, based upon the information above.

|                                    | $\text{PO}_4$                           | $\text{P}^*$                          |
|------------------------------------|-----------------------------------------|---------------------------------------|
| Minimum value of annual deposition | = 0.9 $\text{mg}/\text{m}^2/\text{yr.}$ | 0.3 $\text{mg}/\text{m}^2/\text{yr.}$ |
| Maximum value of annual deposition | = 250 $\text{mg}/\text{m}^2/\text{yr.}$ | 82 $\text{mg}/\text{m}^2/\text{yr.}$  |
| Mean value of annual deposition    | = 5.0 $\text{mg}/\text{m}^2/\text{yr.}$ | 1.6 $\text{mg}/\text{m}^2/\text{yr.}$ |

$\text{P}^*$  - Phosphorus concentrations = Phosphates ( $\text{PO}_4$ ) X 0.326

I hope this information is suitable for your purposes and meets your requirements.

Mark Bennett

MB/lp

cc: D. Regehr  
D. Bezak

Appendix IV(a-i)

STATION W0923, SOURCE - DITCH LAKE  
SAMPLING LOCATION - S E END LATITUDE 50.34 LONGITUDE 099.56

FROM 05 06 01  
TO 06 01 31

| DATE     | COD   | T.R. | P.R. | N.F.R. | PH   | ALKALINITY | ALKALINITY | ALKALINITY | ALKALINITY |
|----------|-------|------|------|--------|------|------------|------------|------------|------------|
|          | MG/L  | MG/L | MG/L | MG/L   | MG/L | MG/L       | MG/L       | MG/L       | MG/L       |
| 05 07 02 | 371.0 | 250. | 250. | 5. L   | 0.59 | 186.       | 217.       | 5.         | 0.         |
| 05 07 08 | 341.0 | 240. | 240. | 5. L   | 0.60 | 168.       | 165.       | 10.        | 0.         |
| 05 07 15 | 330.0 | 230. | 230. | 6.     | 0.60 | 156.       | 161.       | 5.         | 0.         |
| 05 07 22 | 331.0 | 210. | 210. | 5. L   | 0.55 | 154.       | 173.       | 7.         | 0.         |
| 05 10 22 | 389.0 | 270. | 270. | 5. L   | 0.25 | 192.       | 234.       | 0.         | 0.         |
| 06 01 13 | 551.0 | 360. | 360. | 5. L   | 7.35 | 266.       | 325.       | 0.         | 0.         |

| DATE     | CALCIUM | MAGNESIUM | HARDNESS | MANGANESE | IRON | POTASSIUM | SODIUM | DO   | TURBIDITY |
|----------|---------|-----------|----------|-----------|------|-----------|--------|------|-----------|
|          | MG/L    | MG/L      | MG/L     | MG/L      | MG/L | MG/L      | MG/L   | MG/L | NTU       |
| 05 07 02 | 44.     | 22.       | 207.     | 0.07      | 0.12 | 5. L      | 6.     | 11.5 | 1.00      |
| 05 07 08 | 38.     | 22.       | 183.     | 0.05      | 0.03 | 5. L      | 8.     | 10.0 | 1.00      |
| 05 07 15 | 35.     | 22.       | 177.     | 0.06      | 0.06 | 5. L      | 8.     | 6.0  | 3.00      |
| 05 07 22 | 31.     | 21.       | 165.     | 0.04      | 0.05 | 5. L      | 8.     | 9.9  | 1.00      |
| 05 10 22 | 52.     | 25.       | 234.     | 0.06      | 0.07 | 5. L      | 8.     | 10.6 | 1.50      |
| 06 01 13 | 45.     | 23.       | 208.     | 0.23      | 0.04 | 7.        | 12.    | 0.1  | 2.50      |

| DATE     | SILICA | TKN  | NH3 + NH4 | NO3-NO2 | P-TOTAL | CHLORIDE | SULPHATE | CHLORO-A | T-COLI     |
|----------|--------|------|-----------|---------|---------|----------|----------|----------|------------|
|          | MG/L   | MG/L | MG/L      | MG/L    | MG/L    | MG/L     | MG/L     | MG/L     | MPN/100 ML |
| 05 07 02 | 9.5    | 0.00 | 0.01      | 0.01 L  | 0.025   | 3.       | 23.      | 4.4      | 7          |
| 05 07 08 | 8.2    | 0.00 | 0.03      | 0.01 L  | 0.030   | 3.       | 23.      | 9.6      | 9          |
| 05 07 15 | 7.6    | 1.00 | 0.03      | 0.01 L  | 0.025   | 3.       | 30.      | 4.4      | 4          |
| 05 07 22 | 7.6    | 1.00 | 0.03      | 0.01 L  | 0.030   | 2.       | 20.      | 4.4      | 9          |
| 05 10 22 | 18.0   | 1.00 | 0.02      | 0.01 L  | 0.030   | 3.       | 25.      | ---      | ---        |
| 06 01 13 | 28.0   | 2.00 | 0.63      | 0.01 L  | 0.100   | 7.       | 38.      | ---      | ---        |

| DATE     | F-COLI     | SECCHI DISC |
|----------|------------|-------------|
|          | MPN/100 ML | METRES      |
| 05 07 02 | 0          | 1.90        |
| 05 07 08 | 0          | 1.50        |
| 05 07 15 | 0          | 2.00        |
| 05 07 22 | 0          | 2.00        |
| 05 10 22 | ---        | 1.30        |
| 06 01 13 | ---        | ---         |

Appendix IV(a-11)

STATION 400924, SOURCE - DITCH LAKE  
SAMPLING LOCATION - MIDDLE LATITUDE 50.34 LONGITUDE 099.56

FROM 05 06 01  
TO 06 01 31

| DATE     | COD<br>US/CM | T.R.<br>MG/L | F.R.<br>MG/L | M.F.R.<br>MG/L | PH<br>UNITS | ALKALINITY<br>MG(CACO3)/L | ALKALINITY<br>MG(CACO3)/L | ALKALINITY<br>MG(CACO3)/L | ALKALINITY<br>MG(CACO3)/L |
|----------|--------------|--------------|--------------|----------------|-------------|---------------------------|---------------------------|---------------------------|---------------------------|
| 05 07 02 | 360.0        | 260.         | 260.         | 5. L           | 0.30        | 170.                      | 207.                      | 170.                      | 0.                        |
| 05 07 06 | 371.0        | 250.         | 250.         | 5. L           | 0.50        | 162.                      | 170.                      | 170.                      | 0.                        |
| 05 07 15 | 365.0        | 250.         | 250.         | 5. L           | 0.40        | 150.                      | 160.                      | 160.                      | 0.                        |
| 05 07 22 | 371.0        | 230.         | 230.         | 5. L           | 0.55        | 160.                      | 160.                      | 160.                      | 0.                        |
| 05 07 29 | 369.0        | 220.         | 220.         | 5. L           | 0.70        | 152.                      | 171.                      | 171.                      | 0.                        |
| 05 08 06 | 362.0        | 240.         | 240.         | 5. L           | 0.50        | 154.                      | 160.                      | 160.                      | 0.                        |
| 05 08 13 | 359.0        | 250.         | 250.         | 5. L           | 0.25        | 160.                      | 195.                      | 195.                      | 0.                        |
| 05 08 19 | 352.0        | 240.         | 240.         | 5. L           | 0.70        | 150.                      | 170.                      | 170.                      | 0.                        |
| 05 08 26 | 356.0        | 250.         | 250.         | 5. L           | 0.15        | 166.                      | 203.                      | 203.                      | 0.                        |
| 05 10 22 | 350.0        | 250.         | 250.         | 5. L           | 0.00        | 192.                      | 234.                      | 234.                      | 0.                        |
| 06 01 13 | 427.0        | 290.         | 290.         | 5. L           | 0.00        | 192.                      | 234.                      | 234.                      | 0.                        |

| DATE     | CALCIUM<br>MG(CA)/L | MAGNESIUM<br>MG(MG)/L | HARDNESS<br>MG(CACO3)/L | MANGANESE<br>MG(MN)/L | IRON<br>MG(Fe)/L | POTASSIUM<br>MG(K)/L | SODIUM<br>MG(Na)/L | DO<br>MG(O2)/L | TURBIDITY<br>NTU |
|----------|---------------------|-----------------------|-------------------------|-----------------------|------------------|----------------------|--------------------|----------------|------------------|
| 05 07 02 | 41.                 | 22.                   | 195.                    | 0.03                  | 0.02             | 6.                   | 10.                | 8.4            | 1.00             |
| 05 07 06 | 34.                 | 22.                   | 160.                    | 0.05                  | 0.02             | 5.                   | 10.                | 10.0           | 1.00             |
| 05 07 15 | 30.                 | 22.                   | 160.                    | 0.04                  | 0.02             | 5.                   | 10.                | 6.1            | 1.50             |
| 05 07 22 | 30.                 | 21.                   | 170.                    | 0.09                  | 0.02             | 5.                   | 10.                | 6.2            | 1.00             |
| 05 07 29 | 37.                 | 22.                   | 160.                    | 0.00                  | 0.02             | 5.                   | 11.                | 6.2            | 1.00             |
| 05 08 06 | 35.                 | 23.                   | 160.                    | 0.04                  | 0.02             | 5.                   | 10.                | 6.1            | 1.00             |
| 05 08 13 | 30.                 | 23.                   | 170.                    | 0.04                  | 0.02             | 5.                   | 10.                | 6.1            | 1.00             |
| 05 08 19 | 40.                 | 24.                   | 160.                    | 0.07                  | 0.02             | 5.                   | 11.                | 6.2            | 1.00             |
| 05 08 26 | 40.                 | 24.                   | 160.                    | 0.07                  | 0.13             | 5.                   | 11.                | 9.7            | 0.55             |
| 05 10 22 | 44.                 | 24.                   | 209.                    | 0.02                  | 0.03             | 5.                   | 9.                 | 10.9           | 1.00             |
| 06 01 13 | 35.                 | 20.                   | 171.                    | 0.02                  | 0.02             | 5.                   | 11.                | ---            | 0.70             |

| DATE     | SILICA<br>MG(SIO2)/L | THIN<br>MG(NH)/L | 1013 + 1014<br>MG(NH)/L | NO3-NO2<br>MG(N)/L | P-TOTAL<br>MG(P)/L | CHLORIDE<br>MG(CL)/L | SULPHATE<br>MG(SO4)/L | CHLORO-A<br>US/L | T. COLI<br>MPN/100 ML |
|----------|----------------------|------------------|-------------------------|--------------------|--------------------|----------------------|-----------------------|------------------|-----------------------|
| 05 07 02 | 13.0                 | 0.05             | 0.07                    | 0.02               | 0.020              | 3.                   | 30.                   | 16.6             | 0                     |
| 05 07 06 | 10.0                 | 0.05             | 0.01                    | 0.01               | 0.030              | 3.                   | 20.                   | 19.2             | 9                     |
| 05 07 15 | 13.0                 | 0.05             | 0.02                    | 0.01               | 0.030              | 4.                   | 30.                   | 20.2             | 4                     |
| 05 07 22 | 10.0                 | 0.00             | 0.06                    | 0.01               | 0.030              | 3.                   | 20.                   | 6.7              | 4                     |
| 05 07 29 | 14.0                 | 1.00             | 0.01                    | 0.01               | 0.040              | 4.                   | 33.                   | 11.4             | 23                    |
| 05 08 06 | 15.0                 | 1.10             | 0.09                    | 0.01               | 0.035              | 3.                   | 20.                   | 15.7             | 7                     |
| 05 08 13 | 16.0                 | 1.10             | 0.06                    | 0.02               | 0.040              | 3.                   | 193.                  | 14.6             | 0                     |
| 05 08 19 | 17.0                 | 0.00             | 0.01                    | 0.01               | 0.035              | 3.                   | 30.                   | 15.7             | 9                     |
| 05 08 26 | 16.0                 | 1.00             | 0.02                    | 0.01               | 0.030              | 4.                   | 20.                   | ---              | ---                   |
| 05 10 22 | 20.0                 | 0.90             | 0.05                    | 0.12               | 0.025              | 4.                   | 35.                   | ---              | ---                   |
| 06 01 13 | 20.0                 | 0.90             | 0.05                    | 0.12               | 0.025              | 4.                   | 35.                   | ---              | ---                   |

F. COLI  
MPN/100 ML

DATE

| DATE     | F. COLI<br>MPN/100 ML | SECCI DISC<br>METRES |
|----------|-----------------------|----------------------|
| 05 07 02 | 0                     | 1.90                 |
| 05 07 06 | 0                     | 2.00                 |
| 05 07 15 | 0                     | 1.90                 |
| 05 07 22 | 0                     | 1.90                 |
| 05 07 29 | 0                     | 1.30                 |
| 05 08 06 | 0                     | 1.00                 |
| 05 08 13 | 0                     | 1.00                 |
| 05 08 19 | 0                     | 1.30                 |
| 05 08 26 | 0                     | 0.50                 |
| 05 10 22 | ---                   | 2.40                 |
| 06 01 13 | ---                   | ---                  |

Appendix IV(a-iii)

STATION 000215, SOURCE - DITCH LAKE  
SAMPLING LOCATION - N.E. END LATITUDE 50:34 LONGITUDE 099:56

FROM 05 06 01  
TO 06 01 31

| DATE     | COND<br>US/CM | T.R.<br>MG/L | F.R.<br>MG/L | N.P.R.<br>MG/L | PH<br>UNITS | ALPHEINITY<br>MG/CAC03/L | ALPHEINITY<br>MG/CO3/L | ALPHEINITY<br>MG/CO3/L | ALPHEINITY<br>MG/CO3/L |
|----------|---------------|--------------|--------------|----------------|-------------|--------------------------|------------------------|------------------------|------------------------|
| 05 07 02 | 376.0         | 270.         | 270.         | 5. L           | 0.60        | 165.                     | 193.                   | 5.                     | 0.                     |
| 05 07 08 | 372.0         | 266.         | 266.         | 5. L           | 0.55        | 164.                     | 188.                   | 7.                     | 0.                     |
| 05 07 15 | 371.0         | 260.         | 260.         | 5. L           | 0.55        | 162.                     | 185.                   | 5.                     | 0.                     |
| 05 07 22 | 369.0         | 260.         | 260.         | 5. L           | 0.60        | 158.                     | 178.                   | 7.                     | 0.                     |
| 05 07 29 | 369.0         | 230.         | 230.         | 5. L           | 0.65        | 158.                     | 178.                   | 5.                     | 0.                     |
| 05 08 06 | 350.0         | 240.         | 240.         | 5. L           | 0.50        | 152.                     | 176.                   | 5.                     | 0.                     |
| 05 08 13 | 352.0         | 250.         | 250.         | 5. L           | 0.20        | 160.                     | 195.                   | 0.                     | 0.                     |
| 05 08 19 | 352.0         | 250.         | 250.         | 5. L           | 0.35        | 158.                     | 186.                   | 2.                     | 0.                     |
| 05 08 26 | 354.0         | 250.         | 250.         | 5. L           | 0.40        | 160.                     | 190.                   | 2.                     | 0.                     |
| 05 10 22 | 349.0         | 260.         | 260.         | 5. L           | 0.30        | 164.                     | 200.                   | 0.                     | 0.                     |
| 06 01 13 | 426.0         | 260.         | 260.         | 5. L           | 7.90        | 192.                     | 234.                   | 0.                     | 0.                     |

| DATE     | CALCIUM<br>MG/CAL/L | MAGNESIUM<br>MG/MG/L | HARDNESS<br>MG/CAC03/L | MANGANESE<br>MG/MN/L | IRON<br>MG/FE/L | POTASSIUM<br>MG/K/L | SODIUM<br>MG/NA/L | DO<br>MG/O2/L | TOXICITY<br>1/10 |
|----------|---------------------|----------------------|------------------------|----------------------|-----------------|---------------------|-------------------|---------------|------------------|
| 05 07 02 | 41.                 | 22.                  | 192.                   | 0.02                 | 0.02            | 4.                  | 10.               | 11.2          | 1.00             |
| 05 07 08 | 37.                 | 21.                  | 181.                   | 0.04                 | 0.02            | 5.                  | 10.               | 7.9           | 0.65             |
| 05 07 15 | 35.                 | 23.                  | 186.                   | 0.05                 | 0.02            | 5.                  | 10.               | 7.5           | 0.90             |
| 05 07 22 | 37.                 | 22.                  | 186.                   | 2.11                 | 2.10            | 5. L                | 10.               | 8.6           | 1.00             |
| 05 07 29 | 36.                 | 23.                  | 166.                   | 0.04                 | 0.02            | 5. L                | 10.               | 8.3           | 0.80             |
| 05 08 06 | 39.                 | 23.                  | 193.                   | 0.14                 | 0.12            | 5. L                | 10.               | 6.1           | 0.60             |
| 05 08 13 | 40.                 | 24.                  | 196.                   | 0.10                 | 0.13            | 5. L                | 10.               | 6.1           | 1.00             |
| 05 08 19 | 35.                 | 21.                  | 176.                   | 0.05                 | 0.12            | 5. L                | 10.               | 9.5           | 1.00             |
| 05 08 26 | 41.                 | 24.                  | 207.                   | 0.02                 | 0.14            | 5.                  | 10.               | 10.8          | 1.00             |
| 06 01 13 | 38.                 | 21.                  | 183.                   | 0.02                 | 0.32            | 5.                  | 10.               | 56.4          | 1.00             |

| DATE     | SILICA<br>MG/SIO2/L | TEH<br>MG/NI/L | HM3 + HM4<br>MG/NI/L | HQ3-HQ2<br>MG/NI/L | P-TOTAL<br>MG/P/L | CHLORIDE<br>MG/CL/L | SULPHATE<br>MG/SO4/L | CHLORIDE-A<br>UC/L | Y. COLI<br>MPN/100 PL |
|----------|---------------------|----------------|----------------------|--------------------|-------------------|---------------------|----------------------|--------------------|-----------------------|
| 05 07 02 | 12.0                | 1.10           | 0.07                 | 0.01               | 0.040             | 3.                  | 30.                  | 22.7               | 0                     |
| 05 07 08 | 12.0                | 0.00           | 0.02                 | 0.01               | 0.030             | 3.                  | 25.                  | 13.0               | 0                     |
| 05 07 15 | 13.0                | 1.00           | 0.07                 | 0.01               | 0.025             | 4.                  | 30.                  | 19.2               | 0                     |
| 05 07 22 | 12.0                | 0.05           | 0.01                 | 0.01               | 0.030             | 4.                  | 28.                  | 12.2               | 0                     |
| 05 07 29 | 14.0                | 0.95           | 0.01                 | 0.01               | 0.050             | 3.                  | 25.                  | 14.0               | 0                     |
| 05 08 06 | 14.0                | 0.90           | 0.03                 | 0.01               | 0.040             | 4.                  | 30.                  | 12.2               | 23                    |
| 05 08 13 | 15.0                | 1.10           | 0.10                 | 0.01               | 0.035             | 4.                  | 20.                  | 14.0               | 0                     |
| 05 08 19 | 17.0                | 0.95           | 0.11                 | 0.02               | 0.060             | 3.                  | 103.                 | 15.7               | 0                     |
| 05 08 26 | 17.0                | 0.05           | 0.02                 | 0.01               | 0.045             | 3.                  | 35.                  | 14.0               | 0                     |
| 05 10 22 | 17.0                | 1.00           | 0.02                 | 0.01               | 0.030             | 4.                  | 35.                  | ---                | ---                   |
| 06 01 13 | 20.0                | 1.00           | 0.07                 | 0.11               | 0.025             | 4.                  | 33.                  | ---                | ---                   |

| DATE     | F. COLI<br>MPN/100 PL | SECCHI DISC<br>METRES |
|----------|-----------------------|-----------------------|
| 05 07 02 | 0                     | 1.40                  |
| 05 07 08 | 0                     | 2.00                  |
| 05 07 15 | 0                     | 1.90                  |
| 05 07 22 | 0                     | 1.70                  |
| 05 07 29 | 0                     | 1.70                  |
| 05 08 06 | 0                     | 1.50                  |
| 05 08 13 | 0                     | 1.20                  |
| 05 08 19 | 0                     | 1.40                  |
| 05 08 26 | 0                     | 1.10                  |
| 05 10 22 | ---                   | 2.50                  |
| 06 01 13 | ---                   | ---                   |

Appendix IV(b-1)

STATION M08129, SOURCE - KERN LAKE  
SAMPLING LOCATION - S END  
LATITUDE 36°13' LONGITUDE 89°41'

FROM 05 06 01  
TO 06 01 31

| DATE     | COD<br>UN/CH | T.R.<br>MG/L | F.R.<br>MG/L | N.P.R.<br>MG/L | PH<br>UNITS | ALKALINITY<br>MG/CAC03/L | ALKALINITY<br>MG/C03/L | ALKALINITY<br>MG/0H/L |
|----------|--------------|--------------|--------------|----------------|-------------|--------------------------|------------------------|-----------------------|
| 05 07 02 | 277.0        | 148.         | 148.         | 5. L           | 9.95        | 104.                     | 105.                   | 12.                   |
| 05 07 06 | 142.0        | 148.         | 148.         | 5. L           | 9.00        | 98.                      | 99.                    | 0.                    |
| 05 07 10 | 142.0        | 148.         | 148.         | 5. L           | 9.15        | 68.                      | 63.                    | 12.                   |
| 05 07 14 | 142.0        | 148.         | 148.         | 5. L           | 9.55        | 78.                      | 61.                    | 17.                   |
| 05 07 18 | 142.0        | 148.         | 148.         | 5. L           | 9.40        | 78.                      | 51.                    | 22.                   |
| 05 07 22 | 142.0        | 148.         | 148.         | 5. L           | 9.85        | 72.                      | 29.                    | 24.                   |
| 05 07 26 | 142.0        | 148.         | 148.         | 5. L           | 9.45        | 68.                      | 49.                    | 24.                   |
| 05 08 06 | 174.0        | 148.         | 148.         | 5. L           | 9.45        | 68.                      | 39.                    | 29.                   |
| 05 08 10 | 174.0        | 148.         | 148.         | 5. L           | 9.45        | 68.                      | 43.                    | 12.                   |
| 05 08 14 | 174.0        | 148.         | 148.         | 5. L           | 9.25        | 68.                      | 33.                    | 0.                    |
| 05 08 18 | 174.0        | 148.         | 148.         | 5. L           | 9.30        | 112.                     | 137.                   | 0.                    |
| 06 01 13 | 234.0        | 138.         | 138.         | 5. L           | 0.30        |                          |                        |                       |

| DATE     | CALCIUM<br>MG/CA/L | MAGNESIUM<br>MG/MG/L | HARDNESS<br>MG/CAC03/L | MANGANESE<br>MG/MN/L | IRON<br>MG/FE/L | POTASSIUM<br>MG/K/L | SODIUM<br>MG/NA/L | DO<br>MG/02/L | TURBIDITY<br>NTU |
|----------|--------------------|----------------------|------------------------|----------------------|-----------------|---------------------|-------------------|---------------|------------------|
| 05 07 02 | 27.                | 13.                  | 126.                   | 0.02                 | 0.02            | 4.                  | 1.                | 10.4          | 1.00             |
| 05 07 06 | 27.                | 13.                  | 114.                   | 0.03                 | 0.02            | 5.                  | 1.                | 10.5          | 1.50             |
| 05 07 10 | 27.                | 13.                  | 104.                   | 0.05                 | 0.02            | 4.                  | 1.                | 10.1          | 2.00             |
| 05 07 14 | 17.                | 13.                  | 94.                    | 0.09                 | 0.02            | 5.                  | 2.                | ---           | 2.00             |
| 05 07 18 | 16.                | 13.                  | 95.                    | 0.11                 | 0.03            | 5. L                | 1.                | 0.8           | 2.50             |
| 05 07 22 | 15.                | 13.                  | 93.                    | 0.05                 | 0.02 L          | 5.                  | 1.                | 7.3           | 2.50             |
| 05 07 26 | 15.                | 13.                  | 92.                    | 0.04                 | 0.02            | 5.                  | 1.                | 7.4           | 2.50             |
| 05 08 06 | 18.                | 14.                  | 105.                   | 0.02                 | 0.02 L          | 5.                  | 2.                | 10.0          | 1.00             |
| 05 08 10 | 18.                | 13.                  | 103.                   | 0.02                 | 0.02 L          | 5.                  | 2.                | 11.2          | 0.55             |
| 05 08 14 | 18.                | 13.                  | 103.                   | 0.02                 | 0.02 L          | 6.                  | 1.                | 11.7          | 1.00             |
| 06 01 13 | 26.                | 14.                  | 110.                   | 0.09                 | 0.02 L          | 6.                  | 1.                | 0.6           | 0.90             |

| DATE     | SILICA<br>MG/SIO2/L | THN<br>MG/M/L | NH3 + NH4<br>MG/N/L | N03-N02<br>MG/N/L | P-TOTAL<br>MG/P/L | CHLORIDE<br>MG/CL/L | SULPHATE<br>MG/SO4/L | CHLORO-A<br>UG/L | T-COLI<br>MPN/100 ML |
|----------|---------------------|---------------|---------------------|-------------------|-------------------|---------------------|----------------------|------------------|----------------------|
| 05 07 02 | 3.2                 | 0.95          | 0.00                | 0.01              | 0.025             | 2. L                | 12.                  | 4.7              | 4                    |
| 05 07 06 | 2.6                 | 0.95          | 0.01                | 0.01              | 0.020             | 2. L                | 13.                  | 4.1              | 9                    |
| 05 07 10 | 2.6                 | 0.95          | 0.01                | 0.01              | 0.020             | 2. L                | 20.                  | 11.4             | 9                    |
| 05 07 14 | 3.4                 | 0.95          | 0.02                | 0.01              | 0.025             | 2. L                | 12.                  | 10.5             | 0                    |
| 05 07 18 | 3.4                 | 1.00          | 0.02                | 0.01              | 0.035             | 2. L                | 11.                  | 6.7              | 0                    |
| 05 07 22 | 2.9                 | 0.95          | 0.05                | 0.01              | 0.030             | 2. L                | 11.                  | 4.9              | 4                    |
| 05 08 06 | 3.0                 | 0.95          | 0.04                | 0.02              | 0.035             | 2. L                | 12.                  | 3.1              | 9                    |
| 05 08 10 | 3.0                 | 0.75          | 0.04                | 0.02              | 0.035             | 2. L                | 11.                  | 3.1              | 0                    |
| 05 08 14 | 3.2                 | 0.90          | 0.02                | 0.01              | 0.025             | 2. L                | 11.                  | 1.0              | ---                  |
| 05 08 18 | 3.2                 | 0.90          | 0.01                | 0.01              | 0.025             | 2. L                | 10.                  | ---              | ---                  |
| 06 01 13 | 3.6                 | 0.70          | 0.00                | 0.01              | 0.025             | 2. L                | 10.                  | ---              | ---                  |

| DATE     | P-COLI<br>MPN/100 ML | SECCO DISC<br>METRES |
|----------|----------------------|----------------------|
| 05 07 02 | 0                    | 2.00                 |
| 05 07 06 | 0                    | 2.00                 |
| 05 07 10 | 0                    | 1.50                 |
| 05 07 14 | 0                    | 1.30                 |
| 05 07 18 | 0                    | 1.50                 |
| 05 07 22 | 0                    | 1.50                 |
| 05 08 06 | 0                    | 1.10                 |
| 05 08 10 | 0                    | 2.00                 |
| 05 08 14 | 0                    | 4.00                 |
| 05 08 18 | 0                    | 3.10                 |
| 06 01 13 | ---                  | ---                  |

Appendix IV(b-11)

STATION W0030, SOURCE - KERR LAKE  
SAMPLING LOCATION - MIDDLE LATITUDE 50 30 LONGITUDE 099:01

FROM 05 04 01  
TO 06 01 31

| DATE     | COD<br>US/CM | T.R.<br>MG/L | F.R.<br>MG/L | M.F.R.<br>MG/L | PH<br>UNITS | ALKALINITY<br>MG(CO3)/L | ALKALINITY<br>MG(HCO3)/L | ALKALINITY<br>MG(OH)/L |
|----------|--------------|--------------|--------------|----------------|-------------|-------------------------|--------------------------|------------------------|
| 05 07 02 | 227.0        | 190.         | 190.         | 5. L           | 6.90        | 100.                    | 107.                     | 0.                     |
| 05 07 06 | 210.0        | 170.         | 160.         | 6. L           | 9.25        | 90.                     | 95.                      | 0.                     |
| 05 07 15 | 190.0        | 130.         | 130.         | 5. L           | 9.30        | 80.                     | 73.                      | 0.                     |
| 05 07 22 | 167.0        | 120.         | 110.         | 6. L           | 9.55        | 80.                     | 63.                      | 0.                     |
| 05 07 29 | 160.0        | 110.         | 110.         | 5. L           | 9.70        | 70.                     | 51.                      | 0.                     |
| 05 08 06 | 175.0        | 110.         | 110.         | 5. L           | 9.70        | 70.                     | 48.                      | 0.                     |
| 05 08 13 | 171.0        | 120.         | 120.         | 5. L           | 9.50        | 70.                     | 54.                      | 0.                     |
| 05 08 19 | 172.0        | 140.         | 140.         | 5. L           | 9.60        | 80.                     | 36.                      | 0.                     |
| 05 08 26 | 175.0        | 120.         | 120.         | 5. L           | 9.40        | 80.                     | 31.                      | 0.                     |
| 05 10 22 | 190.0        | 130.         | 120.         | 5. L           | 9.15        | 60.                     | 70.                      | 0.                     |
| 06 01 13 | 200.0        | 140.         | 140.         | 5. L           | 6.70        | 110.                    | 124.                     | 5.                     |

| DATE     | CALCIUM<br>MG(CA)/L | MAGNESIUM<br>MG(MG)/L | HARDNESS<br>MG(CACO3)/L | MANGANESE<br>MG(MN)/L | IRON<br>MG(Fe)/L | POTASSIUM<br>MG(K)/L | SODIUM<br>MG(NA)/L | DO<br>MG(O2)/L | TURBIDITY<br>NTU |
|----------|---------------------|-----------------------|-------------------------|-----------------------|------------------|----------------------|--------------------|----------------|------------------|
| 05 07 02 | 27.                 | 13.                   | 119.                    | 0.02                  | 0.02 L           | 5.                   | 1.                 | 11.0           | 0.05             |
| 05 07 06 | 25.                 | 13.                   | 117.                    | 0.03                  | 0.02 L           | 5.                   | 1.                 | 11.4           | 0.05             |
| 05 07 15 | 21.                 | 14.                   | 103.                    | 0.03                  | 0.02 L           | 5.                   | 1.                 | 10.6           | 2.50             |
| 05 07 22 | 14.                 | 13.                   | 103.                    | 0.06                  | 0.02 L           | 5.                   | 2.                 | ---            | 2.50             |
| 05 07 29 | 16.                 | 13.                   | 95.                     | 0.13                  | 0.02 L           | 5.                   | 1.                 | 9.0            | 1.50             |
| 05 08 06 | 15.                 | 14.                   | 92.                     | 0.05                  | 0.02 L           | 5.                   | 1.                 | 9.7            | 1.50             |
| 05 08 13 | 16.                 | 14.                   | 97.                     | 0.12                  | 0.04 L           | 5.                   | 1.                 | 7.6            | 1.00             |
| 05 08 19 | 17.                 | 14.                   | 101.                    | 0.03                  | 0.02 L           | 5.                   | 1.                 | ---            | 0.50             |
| 05 08 26 | 16.                 | 13.                   | 90.                     | 0.03                  | 0.02 L           | 5.                   | 1.                 | 10.5           | 1.00             |
| 05 10 22 | 19.                 | 13.                   | 100.                    | 0.02 L                | 0.02 L           | 6.                   | 1.                 | 11.9           | 0.75             |
| 06 01 13 | 24.                 | 15.                   | 122.                    | 0.02 L                | 0.02 L           | 6.                   | 1.                 | 9.8            | 0.65             |

| DATE     | SILICA<br>MG(SIO2)/L | TRN<br>MG(M)/L | MU3 + MU4<br>MG(M)/L | MU3-HO2<br>MG(M)/L | P-TOTAL<br>MG(P)/L | CHLORIDE<br>MG(CL)/L | SULPHATE<br>MG(SO4)/L | CHLOROP-A<br>UG/L | T-COLI<br>MPN/100 ML |
|----------|----------------------|----------------|----------------------|--------------------|--------------------|----------------------|-----------------------|-------------------|----------------------|
| 05 07 02 | 3.4                  | 0.70           | 0.00 L               | 0.01 L             | 0.020              | 2. L                 | 13.                   | 5.3               | 4                    |
| 05 07 06 | 3.0                  | 0.70           | 0.01                 | 0.01 L             | 0.020              | 2. L                 | 13.                   | 6.1               | 9                    |
| 05 07 15 | 2.6                  | 0.90           | 0.01                 | 0.01 L             | 0.020              | 2. L                 | 20.                   | 8.7               | 0                    |
| 05 07 22 | 2.6                  | 0.00           | 0.02                 | 0.01 L             | 0.020              | 2. L                 | 12.                   | 10.5              | 0                    |
| 05 07 29 | 2.5                  | 0.90           | 0.03                 | 0.01 L             | 0.030              | 2. L                 | 11.                   | 10.5              | 0                    |
| 05 08 06 | 2.6                  | 0.00           | 0.07                 | 0.01 L             | 0.030              | 2. L                 | 10.                   | 6.1               | 0                    |
| 05 08 13 | 3.0                  | 0.05           | 0.06                 | 0.01               | 0.035              | 2. L                 | 11.                   | 6.6               | 9                    |
| 05 08 19 | 4.1                  | 0.70           | 0.04                 | 0.01 L             | 0.035              | 2. L                 | 11.                   | 2.2               | 0                    |
| 05 08 26 | 3.5                  | 0.65           | 0.03                 | 0.01 L             | 0.025              | 2. L                 | 11.                   | 1.6               | 7                    |
| 05 10 22 | 0.4                  | 0.05           | 0.01                 | 0.01 L             | 0.015              | 2. L                 | 10.                   | ---               | ---                  |
| 06 01 13 | 0.6                  | 1.00           | 0.07                 | 0.01 L             | 0.020              | 2. L                 | 13.                   | ---               | ---                  |

| DATE     | F-COLI<br>MPN/100 ML | SECCO DISC<br>METRES |
|----------|----------------------|----------------------|
| 05 07 02 | 0                    | 2.90                 |
| 05 07 06 | 4                    | 2.00                 |
| 05 07 15 | 0                    | 1.20                 |
| 05 07 22 | 0                    | 1.20                 |
| 05 07 29 | 0                    | 1.60                 |
| 05 08 06 | 0                    | 1.20                 |
| 05 08 13 | 0                    | 4.00                 |
| 05 08 19 | 0                    | 1.60                 |
| 05 08 26 | 7                    | 2.70                 |
| 05 10 22 | ---                  | ---                  |
| 06 01 13 | ---                  | ---                  |

Appendix IV(biii)

STATION M09311, SOURCE - KERR RIVER  
SAMPLING LOCATION - N END LATITUDE 50°31' LONGITUDE 099°41'

FROM 05 06 01  
TO 06 01 31

| DATE     | COD<br>US/CM | T.R.<br>MG/L | F.B.<br>MG/L | N.F.R.<br>MG/L | PH<br>UNITS | ALKALINITY<br>MG/CAC03/L | ALKALINITY<br>MG/CAC03/L | ALKALINITY<br>MG/CAC03/L | ALKALINITY<br>MG/C03/L |
|----------|--------------|--------------|--------------|----------------|-------------|--------------------------|--------------------------|--------------------------|------------------------|
| 05 07 02 | 287.0        | 190.         | 190.         | 5. L           | 9.00        | 100.                     | 107.                     | 12.                      | 0.                     |
| 05 07 08 | 203.0        | 150.         | 150.         | 5. L           | 9.15        | 94.                      | 85.                      | 14.                      | 0.                     |
| 05 07 15 | 175.0        | 120.         | 120.         | 5. L           | 8.25        | 70.                      | 44.                      | 24.                      | 0.                     |
| 05 07 22 | 420.0        | 310.         | 310.         | 12. L          | 9.00        | 160.                     | 195.                     | 0.                       | 0.                     |
| 05 07 29 | 170.0        | 110.         | 110.         | 5. L           | 9.00        | 70.                      | 32.                      | 29.                      | 0.                     |
| 05 08 05 | 170.0        | 110.         | 110.         | 5. L           | 9.00        | 70.                      | 37.                      | 24.                      | 0.                     |
| 05 08 12 | 170.0        | 110.         | 110.         | 5. L           | 9.40        | 70.                      | 61.                      | 17.                      | 0.                     |
| 05 08 19 | 170.0        | 110.         | 110.         | 5. L           | 9.30        | 60.                      | 59.                      | 19.                      | 0.                     |
| 05 08 26 | 175.0        | 120.         | 120.         | 5. L           | 9.55        | 60.                      | 44.                      | 24.                      | 0.                     |
| 05 10 22 | 105.0        | 120.         | 120.         | 5. L           | 9.25        | 66.                      | 66.                      | 19.                      | 0.                     |
| 06 01 13 | 246.0        | 150.         | 150.         | 5. L           | 8.55        | 116.                     | 132.                     | 5.                       | 0.                     |

| DATE     | CALCIUM<br>MG/CA/L | MAGNESIUM<br>MG/MG/L | HARDNESS<br>MG/CAC03/L | MANGANESE<br>MG/MN/L | IRON<br>MG/FE/L | POTASSIUM<br>MG/K/L | SODIUM<br>MG/NA/L | DO<br>MG/O2/L | TURBIDITY<br>NTU |
|----------|--------------------|----------------------|------------------------|----------------------|-----------------|---------------------|-------------------|---------------|------------------|
| 05 07 02 | 26.                | 13.                  | 110.                   | 0.02                 | 0.02 L          | 5.                  | 1.                | 10.6          | 0.60             |
| 05 07 08 | 23.                | 13.                  | 112.                   | 0.04                 | 0.13            | 5.                  | 1.                | 11.9          | 1.50             |
| 05 07 15 | 16.                | 13.                  | 93.                    | 0.02                 | 0.12 L          | 5.                  | 1.                | 13.2          | 4.00             |
| 05 07 22 | 14.                | 13.                  | 60.                    | 0.02                 | 0.02 L          | 5. L                | 1.                | 13.4          | 4.03             |
| 05 07 29 | 14.                | 13.                  | 90.                    | 0.03                 | 0.02 L          | 5. L                | 1.                | 8.3           | 2.00             |
| 05 08 06 | 14.                | 14.                  | 92.                    | 0.02                 | 0.02 L          | 5.                  | 1.                | 8.9           | 0.99             |
| 05 08 14 | 17.                | 14.                  | 99.                    | 0.05                 | 0.02 L          | 6.                  | 1.                | 9.3           | 0.65             |
| 05 08 19 | 19.                | 14.                  | 100.                   | 0.06                 | 0.04            | 5.                  | 1.                | 10.0          | 0.55             |
| 05 08 26 | 16.                | 12.                  | 91.                    | 0.02                 | 0.02 L          | 2.                  | 1.                | 11.7          | 0.50             |
| 05 10 22 | 22.                | 14.                  | 115.                   | 0.02                 | 0.07            | 2.                  | 1.                | 11.7          | 0.45             |
| 06 01 13 | 24.                | 15.                  | 122.                   | 0.02 L               | 0.02 L          | 7.                  | 1.                | ---           | ---              |

| DATE     | SILICA<br>MG/SIO2/L | TEMP<br>MG/NI/L | NO3 + NO2<br>MG/NI/L | P-TOTAL<br>MG/P/L | CHLORIDE<br>MG/CL/L | SULPHATE<br>MG/SO4/L | CHLORO-A<br>US/L | T. COLI<br>MPN/100 ML |
|----------|---------------------|-----------------|----------------------|-------------------|---------------------|----------------------|------------------|-----------------------|
| 05 07 02 | 3.4                 | 0.70            | 0.00                 | 0.020             | 2. L                | 13.                  | 2.6              | 0                     |
| 05 07 08 | 3.0                 | 0.70            | 0.01                 | 0.020             | 2. L                | 15.                  | 4.4              | 0                     |
| 05 07 15 | 2.4                 | 0.90            | 0.00                 | 0.01 L            | 2. L                | 50.                  | 14.0             | 0                     |
| 05 07 22 | 13.0                | 2.00            | 0.00                 | 0.095             | 2. L                | 32.                  | 31.5             | 0                     |
| 05 07 29 | 2.4                 | 0.85            | 0.03                 | 0.020             | 2. L                | 12.                  | 14.0             | 0                     |
| 05 08 06 | 2.7                 | 0.60            | 0.03                 | 0.020             | 2. L                | 12.                  | 11.6             | 9                     |
| 05 08 13 | 3.6                 | 0.75            | 0.03                 | 0.025             | 2. L                | 11.                  | 3.5              | 7                     |
| 05 08 19 | 4.2                 | 0.70            | 0.03                 | 0.025             | 2. L                | 11.                  | 5.3              | 0                     |
| 05 08 26 | 3.7                 | 0.60            | 0.01                 | 0.020             | 2. L                | 10.                  | ---              | ---                   |
| 05 10 22 | 0.3                 | 0.90            | 0.01                 | 0.015             | 2. L                | 15.                  | ---              | ---                   |
| 06 01 13 | 0.7                 | 1.00            | 0.03                 | 0.015             | 2. L                | ---                  | ---              | ---                   |

| DATE     | F. COLI<br>MPN/100 ML | SECCI DISC<br>REIMS |
|----------|-----------------------|---------------------|
| 05 07 02 | 0                     | 2.20                |
| 05 07 08 | 0                     | 2.00                |
| 05 07 15 | 0                     | 1.60                |
| 05 07 22 | 0                     | 1.40                |
| 05 07 29 | 0                     | 2.20                |
| 05 08 06 | 0                     | 1.60                |
| 05 08 13 | 4                     | 3.00                |
| 05 08 19 | 0                     | 2.90                |
| 05 08 26 | ---                   | ---                 |
| 05 10 22 | ---                   | ---                 |
| 06 01 13 | ---                   | ---                 |

Appendix IV(c-i)

STATION W0926, SOURCE - OTTER LAKE  
SAMPLING LOCATION - N END LATITUDE 50:31 LONGITUDE 099:50

FROM 85 06 01  
TO 86 01 31

| DATE     | COND<br>US/CM | T.R.<br>MG/L | F.B.<br>MG/L | N.F.B.<br>MG/L | PH<br>UNITS | ALKALINITY<br>MG/CAC/1/L | ALKALINITY<br>MG/CO3/1/L | ALKALINITY<br>MG/CO3/1/L | ALKALINITY<br>MG/CO3/1/L |
|----------|---------------|--------------|--------------|----------------|-------------|--------------------------|--------------------------|--------------------------|--------------------------|
| 85 07 02 | 393.0         | 320.         | 388.         | 18.            | 8.45        | 140.                     | 171.                     | 171.                     | 0.                       |
| 85 07 06 | 396.0         | 320.         | 318.         | 18.            | 8.45        | 140.                     | 171.                     | 171.                     | 0.                       |
| 85 07 10 | 403.0         | 320.         | 318.         | 18.            | 8.45        | 140.                     | 171.                     | 171.                     | 0.                       |
| 85 07 22 | 412.0         | 320.         | 318.         | 17.            | 8.32        | 138.                     | 168.                     | 168.                     | 0.                       |
| 85 07 29 | 369.0         | 320.         | 310.         | 22.            | 8.50        | 164.                     | 198.                     | 198.                     | 0.                       |
| 85 08 06 | 411.0         | 320.         | 320.         | 14.            | 8.45        | 154.                     | 173.                     | 173.                     | 0.                       |
| 85 08 13 | 396.0         | 320.         | 309.         | 25.            | 8.55        | 154.                     | 173.                     | 173.                     | 0.                       |
| 85 08 19 | 402.0         | 320.         | 310.         | 21.            | 8.55        | 160.                     | 193.                     | 193.                     | 0.                       |
| 85 08 26 | 395.0         | 320.         | 309.         | 16.            | 8.50        | 166.                     | 193.                     | 193.                     | 0.                       |
| 85 10 22 | 434.0         | 340.         | 310.         | 28.            | 8.25        | 100.                     | 220.                     | 220.                     | 0.                       |
| 86 01 13 | 819.0         | 560.         | 560.         | 5. L           | 7.60        | 344.                     | 420.                     | 420.                     | 0.                       |

| DATE     | CALCIUM<br>MG/CA/L | MAGNESIUM<br>MG/MG/L | HARDNESS<br>MG/CAC/1/L | MANGANESE<br>MG/MN/L | IRON<br>MG/FE/L | POTASSIUM<br>MG/K/L | SODIUM<br>MG/NA/L | DO<br>MG/O2/L | TURBIDITY<br>NTU |
|----------|--------------------|----------------------|------------------------|----------------------|-----------------|---------------------|-------------------|---------------|------------------|
| 85 07 02 | 37.                | 25.                  | 193.                   | 0.19                 | 0.05            | 11.                 | 9.                | 10.0          | 4.00             |
| 85 07 06 | 37.                | 26.                  | 199.                   | 0.29                 | 0.05            | 11.                 | 10.               | 10.0          | 4.00             |
| 85 07 10 | 39.                | 27.                  | 206.                   | 0.31                 | 0.07            | 11.                 | 10.               | 6.3           | 3.50             |
| 85 07 22 | 41.                | 26.                  | 209.                   | 0.32                 | 0.06            | 12.                 | 10.               | 6.2           | 5.00             |
| 85 07 29 | 41.                | 28.                  | 219.                   | 0.26                 | 0.05            | 12.                 | 10.               | 6.0           | 4.00             |
| 85 08 06 | 38.                | 28.                  | 210.                   | 0.18                 | 0.05            | 12.                 | 10.               | 6.4           | 4.00             |
| 85 08 13 | 41.                | 29.                  | 219.                   | 0.19                 | 0.04            | 11.                 | 10.               | 10.3          | 7.00             |
| 85 08 19 | 44.                | 29.                  | 230.                   | 0.19                 | 0.04            | 11.                 | 9.                | 8.2           | 4.00             |
| 85 08 26 | 41.                | 28.                  | 199.                   | 0.07                 | 0.02 L          | 11.                 | 10.               | 10.2          | 8.50             |
| 85 10 22 | 51.                | 30.                  | 251.                   | 0.07                 | 0.02 L          | 11.                 | 10.               | 8.5           | 3.50             |
| 86 01 13 | 81.                | 58.                  | 407.                   | 0.64                 | 0.03            | 19.                 | 19.               | 2.5           | 3.50             |

| DATE     | SILICA<br>MG/SI/L | THN<br>MG/TH/L | NO3 + NH4<br>MG/N/L | NO3-NO2<br>MG/NI/L | P-TOTAL<br>MG/P/L | CHLORIDE<br>MG/CL/L | SULPHATE<br>MG/SO4/L | CHLORO-A<br>MG/L | T. COLI<br>MPN/100 ML |
|----------|-------------------|----------------|---------------------|--------------------|-------------------|---------------------|----------------------|------------------|-----------------------|
| 85 07 02 | 8.3               | 2.60           | 0.02                | 0.01 L             | 0.055             | 3.                  | 58.                  | 31.5             | 15                    |
| 85 07 06 | 11.0              | 2.38           | 0.02                | 0.01 L             | 0.055             | 3.                  | 58.                  | 32.5             | 9                     |
| 85 07 10 | 11.0              | 2.68           | 0.02                | 0.01 L             | 0.055             | 4.                  | 58.                  | 32.5             | 23                    |
| 85 07 22 | 14.0              | 2.50           | 0.01                | 0.01 L             | 0.080             | 3.                  | 53.                  | 42.0             | 9                     |
| 85 07 29 | 18.0              | 2.53           | 0.01                | 0.01 L             | 0.090             | 3.                  | 53.                  | 49.9             | 9                     |
| 85 08 06 | 19.0              | 2.60           | 0.06                | 0.01 L             | 0.095             | 3.                  | 60.                  | 49.0             | 75                    |
| 85 08 13 | 18.0              | 2.60           | 0.13                | 0.01 L             | 0.200             | 3.                  | 53.                  | 45.8             | 15                    |
| 85 08 19 | 19.0              | 2.43           | 0.14                | 0.01 L             | 0.085             | 3.                  | 56.                  | 39.5             | 9                     |
| 85 08 26 | 18.0              | 1.50           | 0.01                | 0.01 L             | 0.070             | 3.                  | 49.                  | 21.0             | 43                    |
| 85 10 22 | 11.0              | 2.10           | 0.01                | 0.01 L             | 0.090             | 3.                  | 48.                  | ---              | ---                   |
| 86 01 13 | 17.0              | 2.97           | 0.43                | 0.01 L             | 0.050             | 6.                  | 28.                  | ---              | ---                   |

| DATE     | F. COLI<br>MPN/100 ML | SECOND DISC<br>METRES |
|----------|-----------------------|-----------------------|
| 85 07 02 | 0                     | 0.30                  |
| 85 07 06 | 0                     | 0.40                  |
| 85 07 10 | 9                     | 0.20                  |
| 85 07 22 | 0                     | 0.20                  |
| 85 07 29 | 0                     | 0.20                  |
| 85 08 06 | 20                    | 0.30                  |
| 85 08 13 | 9                     | 0.30                  |
| 85 08 19 | 0                     | 0.40                  |
| 85 08 26 | 23                    | 0.50                  |
| 85 10 22 | ---                   | ---                   |
| 86 01 13 | ---                   | ---                   |

Appendix IV(c-11)

STATION W00027, SOURCE - OTTER LAKE  
SAMPLING LOCATION - MIDDLE LATITUDE 50:30 LONGITUDE 099:50

FROM 05 06 01  
TO 06 01 31

| DATE     | CODD<br>US/CH | T.M.<br>MG/L | P.R.<br>MG/L | H.F.R.<br>MG/L | PH UNITS | ALKALINITY<br>MG/CACO3/L | ALKALINITY<br>MG/CACO3/L | ALKALINITY<br>MG/CACO3/L | ALKALINITY<br>MG/CACO3/L |
|----------|---------------|--------------|--------------|----------------|----------|--------------------------|--------------------------|--------------------------|--------------------------|
| 05 07 02 | 391.0         | 310.         | 310.         | 19.            | 8.75     | 142.                     | 159.                     | 7.                       | 0.                       |
| 05 07 08 | 399.0         | 310.         | 310.         | 20.            | 8.35     | 158.                     | 178.                     | 2.                       | 0.                       |
| 05 07 15 | 401.0         | 310.         | 310.         | 19.            | 8.25     | 155.                     | 168.                     | 0.                       | 0.                       |
| 05 07 22 | 410.0         | 310.         | 310.         | 19.            | 8.25     | 155.                     | 193.                     | 0.                       | 0.                       |
| 05 07 29 | 423.0         | 310.         | 310.         | 20.            | 8.40     | 154.                     | 186.                     | 5.                       | 0.                       |
| 05 08 06 | 423.0         | 310.         | 310.         | 19.            | 8.40     | 154.                     | 186.                     | 2.                       | 0.                       |
| 05 08 13 | 406.0         | 310.         | 310.         | 18.            | 8.40     | 149.                     | 165.                     | 5.                       | 0.                       |
| 05 08 19 | 402.0         | 310.         | 310.         | 20.            | 8.35     | 158.                     | 170.                     | 7.                       | 0.                       |
| 05 08 26 | 405.0         | 310.         | 310.         | 19.            | 8.30     | 166.                     | 203.                     | 0.                       | 0.                       |
| 05 10 22 | 427.0         | 310.         | 310.         | 23.            | 8.50     | 172.                     | 205.                     | 2.                       | 0.                       |
| 06 01 13 | 491.0         | 490.         | 490.         | 5.             | 7.50     | 296.                     | 361.                     | 0.                       | 0.                       |

| DATE     | CALCIUM<br>MG/CAL/L | MAGNESIUM<br>MG/MG/L | HARDNESS<br>MG/CACO3/L | HAZARD<br>MG/MG/L | IRON<br>MG/FE/L | POTASSIUM<br>MG/K/L | SODIUM<br>MG/NA/L | BI<br>MG/BI/L | TURBIDITY<br>NTU |
|----------|---------------------|----------------------|------------------------|-------------------|-----------------|---------------------|-------------------|---------------|------------------|
| 05 07 02 | 36.                 | 24.                  | 191.                   | 0.10              | 0.05            | 11.                 | 9.                | 11.7          | 6.52             |
| 05 07 08 | 37.                 | 25.                  | 193.                   | 0.10              | 0.06            | 11.                 | 10.               | 6.2           | 10.00            |
| 05 07 15 | 40.                 | 28.                  | 212.                   | 0.02 L            | 0.02 L          | 11.                 | 10.               | 7.9           | 4.00             |
| 05 07 22 | 41.                 | 27.                  | 211.                   | 0.39              | 0.08            | 12.                 | 10.               | 9.0           | 4.50             |
| 05 07 29 | 40.                 | 26.                  | 209.                   | 0.30              | 0.07            | 12.                 | 9.                | 9.0           | 5.00             |
| 05 08 06 | 40.                 | 28.                  | 214.                   | 0.35              | 0.05            | 12.                 | 10.               | 7.4           | 6.50             |
| 05 08 13 | 42.                 | 29.                  | 223.                   | 0.25              | 0.06            | 11.                 | 10.               | 7.9           | 5.00             |
| 05 08 19 | 42.                 | 28.                  | 221.                   | 0.16              | 0.03            | 11.                 | 10.               | 10.4          | 7.00             |
| 05 08 26 | 40.                 | 24.                  | 199.                   | 0.12              | 0.02 L          | 10.                 | 10.               | 7.7           | 4.00             |
| 05 10 22 | 40.                 | 30.                  | 241.                   | 0.06              | 0.04            | 11.                 | 10.               | 10.0          | 7.00             |
| 06 01 13 | 69.                 | 43.                  | 348.                   | 0.49              | ---             | ---                 | 15.               | 3.9           | 3.00             |

| DATE     | SILICA<br>MG/SIO2/L | TEW<br>MG/L | HAZ & HAZ<br>MG/HA/L | HAZ-HAZ<br>MG/HA/L | P-TOTAL<br>MG/P/L | CHLORIDE<br>MG/CL/L | SULPHATE<br>MG/SO4/L | CHLORIDE-A<br>MG/L | T-COL<br>MG/100 ML |
|----------|---------------------|-------------|----------------------|--------------------|-------------------|---------------------|----------------------|--------------------|--------------------|
| 05 07 02 | 8.2                 | 2.50        | 0.01                 | 0.01 L             | 0.090             | 3.                  | 55.                  | 49.0               | 43                 |
| 05 07 08 | 10.0                | 2.30        | 0.02                 | 0.01 L             | 0.100             | 3.                  | 40.                  | 56.0               | 23                 |
| 05 07 15 | 12.0                | 2.90        | 0.01                 | 0.01 L             | 0.070             | 4.                  | 60.                  | 62.9               | 16                 |
| 05 07 22 | 14.0                | 2.40        | 0.02                 | 0.01 L             | 0.090             | 3.                  | 55.                  | 42.0               | 4                  |
| 05 07 29 | 16.0                | 3.00        | 0.01                 | 0.01 L             | 0.090             | 3.                  | 53.                  | 56.0               | 4                  |
| 05 08 06 | 19.0                | 2.70        | 0.23                 | 0.01 L             | 0.120             | 13.                 | 60.                  | 52.5               | 43                 |
| 05 08 13 | 19.0                | 3.40        | 0.08                 | 0.01 L             | 0.190             | 14.                 | 50.                  | 52.5               | 43                 |
| 05 08 19 | 20.0                | 2.40        | 0.05                 | 0.01 L             | 0.060             | 3.                  | 50.                  | 45.5               | 9                  |
| 05 08 26 | 19.0                | 2.10        | 0.06                 | 0.01 L             | 0.055             | 3.                  | 51.                  | 26.2               | 9                  |
| 05 10 22 | 13.0                | 2.30        | 0.01                 | 0.01 L             | 0.070             | 3.                  | 50.                  | ---                | ---                |
| 06 01 13 | ---                 | 2.00        | 0.50                 | 0.01 L             | 0.050             | 5.                  | ---                  | ---                | ---                |

DATE F.COLL  
MG/100 ML

| DATE     | F.COLL<br>MG/100 ML | SECCHI DISC<br>METRES |
|----------|---------------------|-----------------------|
| 05 07 02 | 4                   | 0.35                  |
| 05 07 08 | 0                   | 0.40                  |
| 05 07 15 | 0                   | 0.20                  |
| 05 07 22 | 0                   | 0.20                  |
| 05 07 29 | 0                   | 0.30                  |
| 05 08 06 | 43                  | 0.30                  |
| 05 08 13 | 9                   | 0.20                  |
| 05 08 19 | 0                   | 0.20                  |
| 05 08 26 | 4                   | 0.30                  |
| 05 10 22 | ---                 | 0.60                  |
| 06 01 13 | ---                 | ---                   |

Appendix IV(c-iii)

STATION WATERS, SOURCE - OTTER LAKE  
SAMPLING LOCATION - W END LATITUDE 56°19' LONGITUDE 09°55'

FROM 05 06 01  
TO 06 01 31

| DATE     | COND<br>US/CM | T.R.<br>MG/L | F.R.<br>MG/L | N.F.R.<br>MG/L | PH<br>UNITS | ALKALINITY<br>MG(CO3)/L | ALKALINITY<br>MG(CO3)/L | ALKALINITY<br>MG(OH)/L |
|----------|---------------|--------------|--------------|----------------|-------------|-------------------------|-------------------------|------------------------|
| 05 07 02 | 340.0         | 340.0        | 340.0        | 16.0           | 8.55        | 146.0                   | 146.0                   | 0.0                    |
| 05 07 08 | 340.0         | 340.0        | 340.0        | 71.0           | 8.55        | 146.0                   | 146.0                   | 0.0                    |
| 05 07 15 | 318.0         | 428.0        | 358.0        | 71.0           | 8.55        | 156.0                   | 156.0                   | 0.0                    |
| 05 07 22 | 374.0         | 308.0        | 358.0        | 5.0            | 9.95        | 78.0                    | 78.0                    | 0.0                    |
| 05 07 23 | 374.0         | 308.0        | 358.0        | 5.0            | 9.95        | 78.0                    | 78.0                    | 0.0                    |
| 05 07 29 | 424.0         | 338.0        | 310.0        | 16.0           | 6.30        | 164.0                   | 200.0                   | 0.0                    |
| 05 08 06 | 424.0         | 340.0        | 320.0        | 15.0           | 7.95        | 162.0                   | 170.0                   | 0.0                    |
| 05 08 13 | 409.0         | 340.0        | 320.0        | 15.0           | 6.30        | 160.0                   | 195.0                   | 0.0                    |
| 05 08 17 | 404.0         | 318.0        | 310.0        | 16.0           | 6.45        | 158.0                   | 183.0                   | 0.0                    |
| 05 08 24 | 410.0         | 338.0        | 320.0        | 15.0           | 6.30        | 164.0                   | 195.0                   | 0.0                    |
| 05 10 22 | 429.0         | 340.0        | 310.0        | 38.0           | 6.25        | 176.0                   | 210.0                   | 0.0                    |
| 06 01 13 | 465.0         | 440.0        | 440.0        | 5.0            | 7.40        | 270.0                   | 339.0                   | 0.0                    |

| DATE     | CALCIUM<br>MG(CA)/L | MAGNESIUM<br>MG(MG)/L | HARDNESS<br>MG(CACO3)/L | BARBAROSE<br>MG(MG)/L | IRON<br>MG(Fe)/L | POTASSIUM<br>MG(K)/L | SODIUM<br>MG(Na)/L | DO<br>MG(O2)/L | TURBIDITY<br>NTU |
|----------|---------------------|-----------------------|-------------------------|-----------------------|------------------|----------------------|--------------------|----------------|------------------|
| 05 07 02 | 36.0                | 26.0                  | 189.0                   | 0.20                  | 0.85             | 11.0                 | 9.0                | 10.0           | 5.00             |
| 05 07 08 | 36.0                | 26.0                  | 191.0                   | 0.38                  | 0.87             | 11.0                 | 9.0                | 4.0            | 15.00            |
| 05 07 15 | 42.0                | 26.0                  | 213.0                   | 0.40                  | 0.13             | 11.0                 | 9.0                | 3.3            | 20.00            |
| 05 07 22 | 39.0                | 27.0                  | 207.0                   | 0.41                  | 0.08             | 12.0                 | 9.0                | ---            | 2.00             |
| 05 07 23 | 39.0                | 27.0                  | 207.0                   | 0.41                  | 0.08             | 12.0                 | 9.0                | ---            | 2.00             |
| 05 07 29 | 39.0                | 26.0                  | 209.0                   | 0.34                  | 0.07             | 11.0                 | 10.0               | 7.0            | 4.00             |
| 05 08 06 | 42.0                | 26.0                  | 216.0                   | 0.42                  | 0.07             | 12.0                 | 10.0               | 6.0            | 5.00             |
| 05 08 13 | 42.0                | 26.0                  | 216.0                   | 0.42                  | 0.07             | 12.0                 | 10.0               | 6.0            | 5.00             |
| 05 08 17 | 43.0                | 29.0                  | 229.0                   | 0.10                  | 0.03             | 11.0                 | 11.0               | 9.2            | 7.50             |
| 05 08 22 | 39.0                | 27.0                  | 207.0                   | 0.41                  | 0.08             | 12.0                 | 9.0                | ---            | 2.00             |
| 05 08 26 | 39.0                | 26.0                  | 202.0                   | 0.10                  | 0.02             | 12.0                 | 10.0               | 6.1            | 3.50             |
| 05 10 22 | 50.0                | 37.0                  | 245.0                   | 0.00                  | 0.05             | 11.0                 | 10.0               | 10.0           | 4.50             |
| 06 01 13 | 63.0                | 42.0                  | 320.0                   | 0.39                  | 0.02             | 15.0                 | 14.0               | 1.4            | 2.50             |

| DATE     | SILICA<br>MG(SIO2)/L | TEN<br>MG(TEN)/L | PHOS + MMA<br>MG(PHOS)/L | NO3-NO2<br>MG(N)/L | P-TOTAL<br>MG(P)/L | CHLORIDE<br>MG(CL)/L | SULPHATE<br>MG(SO4)/L | CHLORIDE-A<br>MG/L | T. COLI<br>PPM/100 ML |
|----------|----------------------|------------------|--------------------------|--------------------|--------------------|----------------------|-----------------------|--------------------|-----------------------|
| 05 07 02 | 8.7                  | 2.70             | 0.02                     | 0.01               | 0.100              | 3.0                  | 55.0                  | 52.5               | 9                     |
| 05 07 08 | 8.9                  | 2.40             | 0.03                     | 0.01               | 0.210              | 3.0                  | 35.0                  | 73.4               | 9                     |
| 05 07 15 | 13.0                 | 2.70             | 0.03                     | 0.01               | 0.090              | 4.0                  | 80.0                  | 42.9               | 9                     |
| 05 07 22 | 2.2                  | 0.80             | 0.01                     | 0.01               | 0.020              | 2.0                  | 13.0                  | 56.0               | ---                   |
| 05 07 23 | 2.2                  | 0.80             | 0.01                     | 0.01               | 0.095              | 3.0                  | 43.0                  | 56.0               | ---                   |
| 05 07 29 | 19.0                 | 3.40             | 0.35                     | 0.01               | 0.100              | 3.0                  | 50.0                  | 42.9               | 23                    |
| 05 08 06 | 28.0                 | 3.00             | 0.20                     | 0.01               | 0.110              | 3.0                  | 53.0                  | 59.4               | 43                    |
| 05 08 13 | 20.0                 | 2.30             | 0.13                     | 0.01               | 0.050              | 2.0                  | 33.0                  | 42.0               | 15                    |
| 05 08 22 | 2.2                  | 0.80             | 0.01                     | 0.01               | 0.020              | 2.0                  | 13.0                  | 56.0               | ---                   |
| 05 08 26 | 20.0                 | 2.40             | 0.06                     | 0.01               | 0.075              | 2.0                  | 40.0                  | 38.5               | ---                   |
| 05 10 22 | 14.0                 | 2.50             | 0.01                     | 0.01               | 0.01               | 2.0                  | 75.0                  | ---                | ---                   |
| 06 01 13 | 16.0                 | 2.00             | 0.30                     | 0.01               | 0.000              | 8.0                  | 75.0                  | ---                | ---                   |

| DATE     | F. COLI<br>PPM/100 ML | SECCCHI DISC<br>METRES |
|----------|-----------------------|------------------------|
| 05 07 02 | 0                     | 0.32                   |
| 05 07 08 | 9                     | 0.50                   |
| 05 07 15 | 4                     | 0.20                   |
| 05 07 22 | ---                   | 0.30                   |
| 05 07 23 | ---                   | 0.30                   |
| 05 07 29 | 4                     | 0.20                   |
| 05 08 06 | 4                     | 0.40                   |
| 05 08 13 | 15                    | 0.25                   |
| 05 08 19 | 9                     | 0.30                   |
| 05 08 22 | ---                   | 0.30                   |
| 05 08 26 | 11                    | 0.30                   |
| 05 10 22 | ---                   | 0.40                   |
| 06 01 13 | ---                   | ---                    |

Appendix IV(d-i)

STATION W00912, SOURCE - LITTLE JACKFISH LAKE  
SAMPLING LOCATION - 5 HND LATITUDE 50:29 LONGITUDE 100:05

FROM 05 06 01  
TO 06 01 31

| DATE     | COND<br>US/CH | T.R.<br>MG/L | F.R.<br>MG/L | N.F.R.<br>MG/L | PH<br>UNITS | ALKALINITY<br>MG/CAC03/L | ALKALINITY<br>MG/CA03/L | ALKALINITY<br>MG/CA03/L | ALKALINITY<br>MG/CA03/L |
|----------|---------------|--------------|--------------|----------------|-------------|--------------------------|-------------------------|-------------------------|-------------------------|
| 05 07 02 | 1060.0        | 880.         | 880.         | 5. L           | 8.70        | 342.                     | 370.                    | 38.                     | 0.                      |
| 05 07 09 | 1070.0        | 880.         | 880.         | 12. L          | 8.70        | 342.                     | 370.                    | 38.                     | 0.                      |
| 05 07 16 | 1110.0        | 870.         | 870.         | 5. L           | 8.55        | 350.                     | 400.                    | 14.                     | 0.                      |
| 05 07 23 | 1110.0        | 870.         | 870.         | 5. L           | 8.48        | 362.                     | 400.                    | 14.                     | 0.                      |
| 05 07 30 | 1130.0        | 860.         | 860.         | 5. L           | 8.40        | 366.                     | 412.                    | 17.                     | 0.                      |
| 05 08 07 | 1080.0        | 870.         | 870.         | 5. L           | 8.55        | 360.                     | 420.                    | 10.                     | 0.                      |
| 05 08 14 | 1060.0        | 870.         | 870.         | 5. L           | 8.55        | 342.                     | 350.                    | 14.                     | 0.                      |
| 05 08 20 | 1060.0        | 870.         | 870.         | 5. L           | 8.40        | 350.                     | 380.                    | 16.                     | 0.                      |
| 05 08 26 | 1060.0        | 870.         | 870.         | 5. L           | 8.75        | 348.                     | 381.                    | 22.                     | 0.                      |
| 05 10 24 | 1060.0        | 870.         | 870.         | 5. L           | 8.55        | 356.                     | 353.                    | 24.                     | 0.                      |
| 06 01 15 | 1200.0        | 1000.        | 1000.        | 5. L           | 8.25        | 440.                     | 537.                    | 0.                      | 0.                      |

| DATE     | CALCIUM<br>MG/CA/L | MAGNESIUM<br>MG/MG/L | HARDNESS<br>MG/CAC03/L | MANGANESE<br>MG/MN/L | IRON<br>MG/FE/L | POTASSIUM<br>MG/K/L | SODIUM<br>MG/NA/L | DO<br>MG/O2/L | TURBIDITY<br>NTU |
|----------|--------------------|----------------------|------------------------|----------------------|-----------------|---------------------|-------------------|---------------|------------------|
| 05 07 02 | 45.                | 110.                 | 565.                   | 0.02                 | 0.03            | 30.                 | 20.               | 9.0           | 1.00             |
| 05 07 09 | 53.                | 120.                 | 650.                   | 0.04                 | 0.03            | 30.                 | 23.               | 0.4           | 10.00            |
| 05 07 16 | 47.                | 110.                 | 600.                   | 0.05                 | 0.02            | 31.                 | 20.               | 0.4           | 1.00             |
| 05 07 23 | 47.                | 110.                 | 587.                   | 0.04                 | 0.02            | 32.                 | 22.               | 0.4           | 1.00             |
| 05 07 30 | 46.                | 110.                 | 600.                   | 0.04                 | 0.02            | 33.                 | 23.               | 7.7           | 1.00             |
| 05 08 07 | 47.                | 120.                 | 560.                   | 0.02                 | 0.09            | 34.                 | 21.               | 7.2           | 0.75             |
| 05 08 14 | 44.                | 110.                 | 540.                   | 0.02                 | 0.02            | 31.                 | 24.               | ---           | 1.50             |
| 05 08 20 | 53.                | 110.                 | 647.                   | 0.02                 | 0.02            | 31.                 | 22.               | 9.4           | 0.05             |
| 05 08 26 | 46.                | 113.                 | 580.                   | 0.03                 | 0.02            | 33.                 | 20.               | 10.0          | 4.53             |
| 05 10 24 | 44.                | 110.                 | 540.                   | 0.02                 | 0.04            | 33.                 | 20.               | 6.2           | 3.00             |
| 06 01 15 | 59.                | 133.                 | 694.                   | 0.06                 | 0.04            | 35.                 | 24.               | ---           | ---              |

| DATE     | SILICA<br>MG/SIO2/L | TKN<br>MG/N/L | 1003 + 1004<br>MG/M/L | NO3-NO2<br>MG/N/L | P-TOTAL<br>MG/P/L | CHLORIDE<br>MG/CL/L | SULPHATE<br>MG/SON/L | CHLORIDE-A<br>MG/L | T-COL<br>MG/L/100 ML |
|----------|---------------------|---------------|-----------------------|-------------------|-------------------|---------------------|----------------------|--------------------|----------------------|
| 05 07 02 | 20.0                | 2.20          | 0.01                  | 0.01 L            | 0.140             | 7.                  | 240.                 | 31.5               | 0                    |
| 05 07 09 | 20.0                | 2.10          | 0.02                  | 0.01 L            | 0.130             | 7.                  | 243.                 | 42.0               | 0                    |
| 05 07 16 | 30.0                | 2.20          | 0.01                  | 0.01 L            | 0.160             | 0.                  | 275.                 | 45.5               | 4                    |
| 05 07 23 | 30.0                | 2.10          | 0.01                  | 0.01 L            | 0.160             | 0.                  | 260.                 | 42.0               | 4                    |
| 05 07 30 | 31.0                | 2.20          | 0.01                  | 0.01 L            | 0.150             | 0.                  | 275.                 | 43.7               | 9                    |
| 05 08 07 | 26.0                | 2.10          | 0.03                  | 0.01 L            | 0.145             | 7.                  | 265.                 | 35.0               | 0                    |
| 05 08 14 | 30.0                | 1.90          | 0.02                  | 0.01 L            | 0.160             | 7.                  | 265.                 | 61.2               | 93                   |
| 05 08 20 | 29.0                | 2.00          | 0.00                  | 0.01 L            | 0.160             | 9.                  | 255.                 | 44.6               | 0                    |
| 05 08 26 | 30.0                | 2.10          | 0.01                  | 0.01 L            | 0.157             | 7.                  | 263.                 | 52.5               | 0                    |
| 05 10 24 | 20.0                | 2.10          | 0.02                  | 0.01 L            | 0.157             | 7.                  | 263.                 | ---                | ---                  |
| 06 01 15 | 34.0                | 2.20          | 0.20                  | 0.10              | 0.160             | 9.                  | 275.                 | ---                | ---                  |

DATE F. COLI SECCHI DISC  
MG/L/100 ML METRES

|          |     |      |
|----------|-----|------|
| 05 07 02 | 0   | 0.50 |
| 05 07 09 | 0   | 0.60 |
| 05 07 16 | 0   | 0.60 |
| 05 07 23 | 0   | 0.50 |
| 05 07 30 | 0   | 0.00 |
| 05 08 07 | 0   | 0.50 |
| 05 08 14 | 0   | 0.50 |
| 05 08 20 | 0   | 0.50 |
| 05 08 26 | 0   | 0.75 |
| 05 10 24 | --- | ---  |
| 06 01 15 | --- | ---  |

Appendix IV(d-ii)

STATION 100900, SOURCE - LITTLE JACKFISH LAKE  
SAMPLING LOCATION - MIDDLE LATITUDE 50:29 LONGITUDE 100:05

FROM 05 04 01  
TO 06 01 31

| DATE     | COD<br>US/CH | T.J.<br>MG/L | F.R.<br>MG/L | H.F.R.<br>MG/L | PH<br>UNITS | ALKALINITY<br>MG(CACO3)/L | ALKALINITY<br>MG(CO3)/L | ALKALINITY<br>MG(CO3)/L |
|----------|--------------|--------------|--------------|----------------|-------------|---------------------------|-------------------------|-------------------------|
| 05 07 02 | 1060.0       | 667.         | 800.         | 5. L           | 6.60        | 340.                      | 370.                    | 17. 0.                  |
| 05 07 09 | 1060.0       | 649.         | 820.         | 17. 5. L       | 6.55        | 350.                      | 375.                    | 17. 0.                  |
| 05 07 16 | 1110.0       | 660.         | 840.         | 5. L           | 6.55        | 350.                      | 405.                    | 16. 0.                  |
| 05 07 23 | 1140.0       | 647.         | 840.         | 5. L           | 6.55        | 350.                      | 407.                    | 19. 0.                  |
| 05 07 30 | 1130.0       | 659.         | 850.         | 5. L           | 6.55        | 360.                      | 422.                    | 12. 0.                  |
| 05 08 07 | 1070.0       | 820.         | 820.         | 5. L           | 6.52        | 360.                      | 419.                    | 12. 0.                  |
| 05 08 14 | 1060.0       | 820.         | 810.         | 5. L           | 6.52        | 360.                      | 419.                    | 12. 0.                  |
| 05 08 21 | 1060.0       | 820.         | 810.         | 5. L           | 6.52        | 360.                      | 419.                    | 12. 0.                  |
| 05 08 28 | 1060.0       | 820.         | 810.         | 5. L           | 6.52        | 360.                      | 419.                    | 12. 0.                  |
| 05 08 35 | 1060.0       | 820.         | 810.         | 5. L           | 6.52        | 360.                      | 419.                    | 12. 0.                  |
| 05 10 24 | 1050.0       | 790.         | 780.         | 5. L           | 6.47        | 350.                      | 370.                    | 20. 0.                  |
| 06 01 15 | 1300.0       | 1000.        | 1000.        | 5. L           | 6.45        | 350.                      | 532.                    | 5. 0.                   |

| DATE     | CALCIUM<br>MG(CAL)/L | MAGNESIUM<br>MG(MG)/L | HARDNESS<br>MG(CACO3)/L | MANGANESE<br>MG(MN)/L | IRON<br>MG(Fe)/L | POTASSIUM<br>MG(K)/L | SODIUM<br>MG(Na)/L | DO<br>MG(O2)/L | TURBIDITY<br>NTU |
|----------|----------------------|-----------------------|-------------------------|-----------------------|------------------|----------------------|--------------------|----------------|------------------|
| 05 07 02 | 64.                  | 109.                  | 540.                    | 0.02 L                | 0.02             | 39.                  | 20.                | 10.5           | 2.00             |
| 05 07 09 | 63.                  | 130.                  | 640.                    | 0.00                  | 0.00             | 31.                  | 24.                | 6.3            | 10.00            |
| 05 07 16 | 64.                  | 115.                  | 592.                    | 0.05                  | 0.02             | 31.                  | 20.                | 5.9            | 1.00             |
| 05 07 23 | 64.                  | 112.                  | 577.                    | 0.04                  | 0.03             | 31.                  | 20.                | 6.9            | 0.60             |
| 05 07 30 | 49.                  | 116.                  | 599.                    | 0.03                  | 0.02             | 31.                  | 23.                | 6.9            | 0.95             |
| 05 08 07 | 49.                  | 124.                  | 632.                    | 0.04                  | 0.06             | 31.                  | 22.                | 7.9            | 0.65             |
| 05 08 14 | 49.                  | 122.                  | 625.                    | 0.02                  | 0.04             | 31.                  | 20.                | 7.8            | 0.65             |
| 05 08 21 | 51.                  | 129.                  | 659.                    | 0.02                  | 0.02 L           | 31.                  | 23.                | 10.4           | 0.72             |
| 05 08 28 | 45.                  | 111.                  | 570.                    | 0.03                  | 0.02 L           | 31.                  | 21.                | 9.4            | 0.95             |
| 05 08 35 | 46.                  | 110.                  | 567.                    | 0.04                  | 0.02 L           | 31.                  | 20.                | 11.0           | 4.50             |
| 06 01 15 | 62.                  | 137.                  | 710.                    | 0.05                  | 0.00             | 30.                  | 26.                | 8.3            | 1.50             |

| DATE     | SILICA<br>MG(SIO2)/L | TKN<br>MG(H)/L | HA13 + HA14<br>MG(H)/L | NO3-NO2<br>MG(N)/L | P-TOTAL<br>MG(P)/L | CHLORIDE<br>MG(CL)/L | SULPHATE<br>MG(SO4)/L | CHLORO-A<br>US/L | T.COLI<br>MPN/100 ML |
|----------|----------------------|----------------|------------------------|--------------------|--------------------|----------------------|-----------------------|------------------|----------------------|
| 05 07 02 | 28.0                 | 2.30           | 0.01                   | 0.01 L             | 0.170              | 7.                   | 265.                  | 35.0             | 0                    |
| 05 07 09 | 28.0                 | 2.30           | 0.02                   | 0.01 L             | 0.170              | 7.                   | 265.                  | 42.0             | 0                    |
| 05 07 16 | 30.0                 | 2.20           | 0.04                   | 0.01 L             | 0.170              | 8.                   | 265.                  | 43.7             | 4                    |
| 05 07 23 | 30.0                 | 2.10           | 0.01                   | 0.01 L             | 0.170              | 7.                   | 270.                  | 36.7             | 93                   |
| 05 07 30 | 31.0                 | 2.10           | 0.01                   | 0.01 L             | 0.170              | 7.                   | 270.                  | 32.0             | 1                    |
| 05 08 07 | 26.0                 | 2.10           | 0.00 L                 | 0.01 L             | 0.130              | 7.                   | 270.                  | 32.7             | 0                    |
| 05 08 14 | 31.0                 | 2.00           | 0.03                   | 0.01 L             | 0.170              | 7.                   | 270.                  | 52.5             | 23                   |
| 05 08 21 | 28.0                 | 2.00           | 0.00                   | 0.01 L             | 0.170              | 6.                   | 250.                  | 40.2             | 0                    |
| 05 08 28 | 30.0                 | 2.10           | 0.01                   | 0.01 L             | 0.150              | 7.                   | 265.                  | 49.0             | 23                   |
| 05 10 24 | 28.0                 | 2.10           | 0.00                   | 0.01 L             | 0.130              | 7.                   | 265.                  | ---              | ---                  |
| 06 01 15 | 34.0                 | 2.50           | 0.10                   | 0.14               | 0.160              | 9.                   | 310.                  | ---              | ---                  |

DATE F.COLI SECCCHI DISC  
MPN/100 ML METRES

|          |     |      |
|----------|-----|------|
| 05 07 02 | 0   | 0.50 |
| 05 07 09 | 0   | 0.50 |
| 05 07 16 | 0   | 0.70 |
| 05 07 23 | 0   | 0.60 |
| 05 07 30 | 0   | 0.60 |
| 05 08 07 | 0   | 0.60 |
| 05 08 14 | 0   | 0.60 |
| 05 08 21 | 0   | 0.50 |
| 05 08 28 | 0   | 0.40 |
| 05 10 24 | --- | 0.75 |
| 06 01 15 | --- | ---  |

Appendix IV(d-iii)

STATION 450001, SOURCE - LITTLE JACKFISH LAKE  
SAMPLING LOCATION - N R10 LATITUDE 50:29 LONGITUDE 100:55

FROM 85 06 01  
TO 86 01 31

| DATE     | COD<br>US/CM | T.B.<br>MG/L | F.R.<br>MG/L | N.P.R.<br>MG/L | PH<br>UNITS | ALKALINITY<br>MG/CAC03/L | ALKALINITY<br>MG/HC03/L | ALKALINITY<br>MG/HC03/L | ALKALINITY<br>MG/HC03/L |
|----------|--------------|--------------|--------------|----------------|-------------|--------------------------|-------------------------|-------------------------|-------------------------|
| 85 07 02 | 1070.0       | 690.         | 690.         | 5. L           | 8.45        | 346.                     | 390.                    | 17.                     | 0.                      |
| 85 07 09 | 1110.0       | 620.         | 600.         | 16.            | 8.55        | 350.                     | 485.                    | 17.                     | 0.                      |
| 85 07 16 | 1110.0       | 660.         | 650.         | 6.             | 8.60        | 360.                     | 480.                    | 17.                     | 0.                      |
| 85 07 23 | 1140.0       | 640.         | 640.         | 5. L           | 8.55        | 358.                     | 480.                    | 17.                     | 0.                      |
| 85 07 30 | 1130.0       | 650.         | 600.         | 5. L           | 8.58        | 358.                     | 410.                    | 17.                     | 0.                      |
| 85 08 07 | 1060.0       | 630.         | 630.         | 5. L           | 8.58        | 358.                     | 417.                    | 17.                     | 0.                      |
| 85 08 14 | 1060.0       | 610.         | 610.         | 5. L           | 8.58        | 358.                     | 383.                    | 16.                     | 0.                      |
| 85 08 21 | 1060.0       | 610.         | 610.         | 5. L           | 8.60        | 364.                     | 378.                    | 22.                     | 0.                      |
| 85 08 28 | 1060.0       | 600.         | 600.         | 5. L           | 8.60        | 364.                     | 370.                    | 22.                     | 0.                      |
| 85 10 24 | 1050.0       | 790.         | 790.         | 5. L           | 8.50        | 352.                     | 386.                    | 22.                     | 0.                      |
| 86 01 15 | 1310.0       | 1020.        | 1020.        | 5. L           | 8.30        | 450.                     | 549.                    | 0.                      | 0.                      |

| DATE     | CALCIUM<br>MG/CA02/L | MAGNESIUM<br>MG/MG/L | HARDNESS<br>MG/CAC03/L | MANGANESE<br>MG/MN/L | IRON<br>MG/FE/L | POTASSIUM<br>MG/K/L | SODIUM<br>MG/NA/L | DO<br>MG/02/L | TURBIDITY<br>NTU |
|----------|----------------------|----------------------|------------------------|----------------------|-----------------|---------------------|-------------------|---------------|------------------|
| 85 07 02 | 45.                  | 110.                 | 560.                   | 0.02 L               | 0.02            | 30.                 | 20.               | 10.9          | 0.70             |
| 85 07 09 | 54.                  | 113.                 | 680.                   | 0.04                 | 0.02 L          | 32.                 | 24.               | 7.3           | 10.00            |
| 85 07 16 | 46.                  | 113.                 | 580.                   | 0.06                 | 0.03            | 31.                 | 19.               | 7.0           | 5.00             |
| 85 07 23 | 47.                  | 112.                 | 570.                   | 0.04                 | 0.03            | 32.                 | 21.               | 6.8           | 1.00             |
| 85 07 30 | 49.                  | 120.                 | 610.                   | 0.03                 | 0.02            | 32.                 | 24.               | 7.3           | 0.70             |
| 85 08 07 | 48.                  | 124.                 | 631.                   | 0.04                 | 0.02            | 33.                 | 28.               | 7.2           | 1.50             |
| 85 08 14 | 49.                  | 124.                 | 633.                   | 0.02                 | 0.03            | 33.                 | 28.               | 7.7           | 1.00             |
| 85 08 20 | 53.                  | 128.                 | 659.                   | 0.02 L               | 0.02 L          | 31.                 | 24.               | 9.8           | 1.00             |
| 85 08 26 | 62.                  | 111.                 | 593.                   | 0.04                 | 0.02 L          | 31.                 | 21.               | 9.8           | 0.80             |
| 85 10 24 | 40.                  | 117.                 | 593.                   | 0.02 L               | 0.02 L          | 31.                 | 21.               | 10.9          | 2.00             |
| 86 01 15 | 61.                  | 135.                 | 720.                   | 0.04                 | 0.05            | 36.                 | 25.               | 6.3           | 2.00             |

| DATE     | SILICA<br>MG/SIO2/L | TKN<br>MG/N/L | NO3 + NO2<br>MG/N/L | P-TOTAL<br>MG/P/L | CHLORIDE<br>MG/CL/L | SULPHATE<br>MG/SO4/L | CHLORO-A<br>US/L | T. COLI<br>MPN/100 ML |
|----------|---------------------|---------------|---------------------|-------------------|---------------------|----------------------|------------------|-----------------------|
| 85 07 02 | 27.0                | 2.40          | 0.02                | 0.140             | 7.                  | 245.                 | 36.7             | 3                     |
| 85 07 09 | 26.0                | 2.30          | 0.02                | 0.150             | 7.                  | 245.                 | 32.5             | 0                     |
| 85 07 16 | 30.0                | 2.10          | 0.02                | 0.140             | 6.                  | 245.                 | 43.7             | 19                    |
| 85 07 23 | 29.0                | 2.10          | 0.01                | 0.140             | 7.                  | 245.                 | 30.5             | 4                     |
| 85 07 30 | 32.0                | 2.10          | 0.02                | 0.155             | 7.                  | 270.                 | 45.5             | 0                     |
| 85 08 07 | 31.0                | 2.40          | 0.02                | 0.200             | 7.                  | 273.                 | 33.2             | 0                     |
| 85 08 14 | 26.0                | 1.90          | 0.09                | 0.140             | 8.                  | 248.                 | 54.2             | 0                     |
| 85 08 20 | 30.0                | 2.10          | 0.01                | 0.150             | 7.                  | 270.                 | 35.0             | 4                     |
| 85 08 26 | 28.0                | 2.10          | 0.00                | 0.140             | 7.                  | 270.                 | 49.0             | 7                     |
| 85 10 24 | 35.0                | 2.60          | 0.20                | 0.170             | 9.                  | 316.                 | ---              | ---                   |
| 86 01 15 | 35.0                | 2.60          | 0.20                | 0.170             | 9.                  | 316.                 | ---              | ---                   |

| DATE     | F. COLI<br>MPN/100 ML | SECCHI DISC<br>FETES |
|----------|-----------------------|----------------------|
| 85 07 02 | 0                     | 0.43                 |
| 85 07 09 | 0                     | 0.50                 |
| 85 07 16 | 0                     | 0.79                 |
| 85 07 23 | 0                     | 0.51                 |
| 85 07 30 | 0                     | 0.50                 |
| 85 08 07 | 0                     | 0.60                 |
| 85 08 14 | 0                     | 0.70                 |
| 85 08 20 | 0                     | 0.60                 |
| 85 08 26 | 0                     | 0.50                 |
| 85 10 24 | ---                   | 0.75                 |
| 86 01 15 | ---                   | ---                  |

Appendix IV(e-1)

STATION M0942, SOURCE - SANDY LAKE  
SAMPLING LOCATION - N E END LATITUDE 50:33 LONGITUDE 100:10

FROM 05 04 01  
TO 06 01 31

| DATE     | COND<br>US/CM | T.R.<br>MG/L | F.R.<br>MG/L | N.F.R.<br>MG/L | PH<br>UNITS | ALP/ALCO3/L | ALP/ALCO3/L | ALP/ALCO3/L | ALP/ALCO3/L |
|----------|---------------|--------------|--------------|----------------|-------------|-------------|-------------|-------------|-------------|
| 05 07 03 | 1560.0        | 1410.        | 1300.        | 25.            | 0.60        | 326.        | 334.        | 31.         | 0.          |
| 05 07 09 | 1580.0        | 1360.        | 1300.        | 5.             | 0.55        | 326.        | 307.        | 43.         | 0.          |
| 05 07 16 | 1590.0        | 1340.        | 1340.        | 65.            | 0.65        | 326.        | 315.        | 41.         | 0.          |
| 05 07 23 | 1570.0        | 1310.        | 1310.        | 5.             | 0.60        | 326.        | 319.        | 34.         | 0.          |
| 05 07 30 | 1620.0        | 1320.        | 1320.        | 5.             | 0.65        | 336.        | 337.        | 34.         | 0.          |
| 05 08 07 | 1530.0        | 1300.        | 1300.        | 5.             | 0.60        | 336.        | 334.        | 34.         | 0.          |
| 05 08 14 | 1540.0        | 1290.        | 1290.        | 5.             | 0.65        | 312.        | 307.        | 36.         | 0.          |
| 05 08 16 | 1520.0        | 1280.        | 1280.        | 5.             | 0.75        | 310.        | 334.        | 26.         | 0.          |
| 05 08 20 | 1520.0        | 1270.        | 1270.        | 5.             | 0.60        | 324.        | 332.        | 31.         | 0.          |
| 05 08 27 | 1530.0        | 1270.        | 1270.        | 5.             | 0.70        | 326.        | 342.        | 29.         | 0.          |
| 06 01 15 | 1610.0        | 1400.        | 1400.        | 5.             | 0.75        | 306.        | 432.        | 19.         | 0.          |

| DATE     | CALCIUM<br>MG/L | MAGNESIUM<br>MG/L | HARDNESS<br>MG/CACO3/L | MANGANESE<br>MG/L | IRON<br>MG/L | POTASSIUM<br>MG/L | SODIUM<br>MG/L | DO<br>MG/L | TURBIDITY<br>NTU |
|----------|-----------------|-------------------|------------------------|-------------------|--------------|-------------------|----------------|------------|------------------|
| 05 07 03 | 24.             | 193.              | 858.                   | 0.03              | 0.08         | 41.               | 31.            | 9.4        | 6.00             |
| 05 07 09 | 29.             | 220.              | 978.                   | 0.05              | 0.08         | 48.               | 36.            | 7.1        | 0.25             |
| 05 07 16 | 26.             | 192.              | 854.                   | 0.05              | 0.04         | 48.               | 35.            | 7.2        | 0.23             |
| 05 07 23 | 29.             | 210.              | 940.                   | 0.08              | 0.04         | 39.               | 32.            | 7.5        | 1.05             |
| 05 07 30 | 24.             | 180.              | 820.                   | 0.07              | 0.04         | 48.               | 32.            | 7.6        | 1.05             |
| 05 08 07 | 26.             | 200.              | 921.                   | 0.06              | 0.04         | 45.               | 32.            | ---        | 0.70             |
| 05 08 14 | 27.             | 200.              | 891.                   | 0.05              | 0.06         | 44.               | 30.            | 7.4        | 1.00             |
| 05 08 20 | 29.             | 216.              | 942.                   | 0.05              | 0.03         | 40.               | 36.            | 7.9        | 0.75             |
| 05 08 27 | 25.             | 175.              | 783.                   | 0.05              | 0.02         | 41.               | 30.            | 8.0        | 1.00             |
| 05 10 24 | 28.             | 186.              | 837.                   | 0.03              | 0.05         | 41.               | 31.            | 10.9       | 2.00             |
| 06 01 15 | 32.             | 189.              | 857.                   | 0.06              | 0.05         | 42.               | 36.            | 7.2        | 0.75             |

| DATE     | SILICA<br>MG/L | TKN<br>MG/L | NO3 + NO2<br>MG/L | P-TOTAL<br>MG/L | CHLORIDE<br>MG/L | SULPHATE<br>MG/L | CHLOROP-A<br>MG/L | Y-COLI<br>MPN/100 ML |
|----------|----------------|-------------|-------------------|-----------------|------------------|------------------|-------------------|----------------------|
| 05 07 03 | 5.9            | 1.90        | 0.02              | 0.020           | 12.              | 590.             | 1.3               | 23                   |
| 05 07 09 | 6.2            | 1.90        | 0.02              | 0.01            | 12.              | 560.             | 2.3               | 0                    |
| 05 07 16 | 6.9            | 1.90        | 0.02              | 0.03            | 14.              | 600.             | 3.5               | 0                    |
| 05 07 23 | 7.5            | 2.00        | 0.02              | 0.030           | 13.              | 590.             | 6.1               | 0                    |
| 05 07 30 | 9.             | 2.10        | 0.03              | 0.030           | 13.              | 590.             | 8.7               | 4                    |
| 05 08 07 | 10.            | 1.90        | 0.08              | 0.035           | 12.              | 600.             | 7.0               | 23                   |
| 05 08 14 | 10.6           | 1.90        | 0.08              | 0.035           | 13.              | 600.             | 7.0               | 23                   |
| 05 08 20 | 11.0           | 1.90        | 0.08              | 0.025           | 13.              | 592.             | 7.9               | 3                    |
| 05 08 27 | 10.0           | 2.00        | 0.04              | 0.05            | 13.              | 566.             | ---               | ---                  |
| 05 10 24 | 11.0           | 2.10        | 0.13              | 0.040           | 13.              | 700.             | ---               | ---                  |
| 06 01 15 | 14.0           | 2.60        | 0.32              | 0.020           | 15.              | ---              | ---               | ---                  |

| DATE     | F-COLI<br>MPN/100 ML | SECCHI DISC<br>METRES |
|----------|----------------------|-----------------------|
| 05 07 03 | 0                    | 4.50                  |
| 05 07 09 | 0                    | 4.00                  |
| 05 07 16 | 0                    | 2.50                  |
| 05 07 23 | 0                    | 1.90                  |
| 05 07 30 | 4                    | 1.60                  |
| 05 08 07 | 0                    | 1.60                  |
| 05 08 14 | 0                    | 2.60                  |
| 05 08 20 | 9                    | 1.60                  |
| 05 08 27 | 3                    | 1.20                  |
| 06 01 15 | ---                  | ---                   |

Appendix IV(e-11)

STATION HQ8943, SOURCE - SAGUO LAKE  
SAMPLING LOCATION - MIDDLE LATITUDE 50:13 LONGITUDE 108:10

FROM 65 06 01  
TO 66 01 31

| DATE     | COND<br>US/CM | T.B.<br>MG/L | F.R.<br>MG/L | N.P.R.<br>MG/L | PH<br>UNITS | ALKALINITY<br>MG/CAC03/L | ALKALINITY<br>MG/C03/L | ALKALINITY<br>MG/C03/L |
|----------|---------------|--------------|--------------|----------------|-------------|--------------------------|------------------------|------------------------|
| 65 07 03 | 1540.0        | 1324.        | 1320.        | 5. L           | 6.85        | 318.                     | 31.                    | 0.                     |
| 65 07 09 | 1580.0        | 1360.        | 1360.        | 5. L           | 6.85        | 328.                     | 36.                    | 0.                     |
| 65 07 16 | 1580.0        | 1370.        | 1370.        | 5. L           | 6.90        | 326.                     | 43.                    | 0.                     |
| 65 07 23 | 1570.0        | 1310.        | 1310.        | 5. L           | 6.90        | 336.                     | 33.                    | 0.                     |
| 65 07 30 | 1620.0        | 1340.        | 1340.        | 5. L           | 6.96        | 330.                     | 33.                    | 0.                     |
| 65 08 07 | 1520.0        | 1300.        | 1300.        | 5. L           | 6.93        | 320.                     | 41.                    | 0.                     |
| 65 08 14 | 1530.0        | 1290.        | 1290.        | 5. L           | 6.75        | 322.                     | 35.                    | 0.                     |
| 65 08 20 | 1510.0        | 1260.        | 1260.        | 5. L           | 6.40        | 320.                     | 29.                    | 0.                     |
| 65 08 27 | 1540.0        | 1240.        | 1240.        | 5. L           | 6.40        | 320.                     | 37.                    | 0.                     |
| 65 10 24 | 1530.0        | 1260.        | 1260.        | 5. L           | 6.78        | 326.                     | 37.                    | 0.                     |
| 66 01 15 | 1770.0        | 1500.        | 1500.        | 5. L           | 6.45        | 308.                     | 45.                    | 0.                     |

| DATE     | CALCIUM<br>MG/CA/L | MAGNESIUM<br>MG/MG/L | HARDNESS<br>MG/CAC03/L | MANGANESE<br>MG/MN/L | IRON<br>MG/FE/L | POTASSIUM<br>MG/K/L | SODIUM<br>MG/NA/L | DO<br>MG/O2/L | TURBIDITY<br>NTU |
|----------|--------------------|----------------------|------------------------|----------------------|-----------------|---------------------|-------------------|---------------|------------------|
| 65 07 03 | 25.                | 195.                 | 665.                   | 0.03                 | 0.04            | 40.                 | 31.               | 8.3           | 1.80             |
| 65 07 09 | 27.                | 210.                 | 932.                   | 0.03                 | 0.03            | 40.                 | 34.               | 9.0           | 0.50             |
| 65 07 16 | 26.                | 190.                 | 647.                   | 0.06                 | 0.04            | 36.                 | 32.               | 6.1           | 0.70             |
| 65 07 23 | 27.                | 200.                 | 690.                   | 0.06                 | 0.04            | 36.                 | 32.               | 7.6           | 1.00             |
| 65 07 30 | 25.                | 190.                 | 644.                   | 0.05                 | 0.02            | 46.                 | 32.               | 7.6           | 0.60             |
| 65 08 07 | 25.                | 205.                 | 918.                   | 0.04                 | 0.03            | 47.                 | 30.               | 6.5           | 0.55             |
| 65 08 14 | 27.                | 213.                 | 947.                   | 0.05                 | 0.03            | 40.                 | 35.               | 7.8           | 0.50             |
| 65 08 20 | 26.                | 170.                 | 797.                   | 0.05                 | 0.02            | 40.                 | 32.               | 8.0           | 0.70             |
| 65 08 27 | 26.                | 160.                 | 608.                   | 0.02                 | 0.04            | 43.                 | 31.               | 10.9          | 1.00             |
| 65 10 24 | 27.                | 160.                 | 608.                   | 0.06                 | 0.04            | 43.                 | 34.               | 5.2           | 0.50             |
| 66 01 15 | 31.                | 160.                 | 652.                   | 0.06                 | 0.05            | 43.                 | 34.               | 5.2           | 0.50             |

| DATE     | SILICA<br>MG/SIO2/L | TRN<br>MG/NI/L | FM3 + FM4<br>MG/NI/L | HQ3-HQ2<br>MG/NI/L | P-TOTAL<br>MG/P/L | CHLORIDE<br>MG/CL/L | SULPHATE<br>MG/SO4/L | CHLORO-A<br>MG/L | T-COLI<br>PTU/100 ML |
|----------|---------------------|----------------|----------------------|--------------------|-------------------|---------------------|----------------------|------------------|----------------------|
| 65 07 03 | 6.4                 | 1.90           | 0.01                 | 0.01               | 0.020             | 12.                 | 600.                 | 1.3              | 9                    |
| 65 07 09 | 5.8                 | 1.60           | 0.01                 | 0.01               | 0.020             | 12.                 | 570.                 | 45.5             | 4                    |
| 65 07 16 | 6.0                 | 1.60           | 0.01                 | 0.01               | 0.025             | 14.                 | 600.                 | 11.4             | 0                    |
| 65 07 23 | 6.8                 | 1.90           | 0.03                 | 0.01               | 0.030             | 13.                 | 570.                 | 12.2             | 0                    |
| 65 07 30 | 8.2                 | 2.00           | 0.02                 | 0.01               | 0.025             | 13.                 | 613.                 | 7.0              | 0                    |
| 65 08 07 | 8.5                 | 2.00           | 0.03                 | 0.01               | 0.025             | 13.                 | 613.                 | 11.6             | 6                    |
| 65 08 14 | 9.7                 | 1.50           | 0.00                 | 0.01               | 0.025             | 13.                 | 568.                 | 7.9              | 7                    |
| 65 08 20 | 9.8                 | 2.00           | 0.11                 | 0.01               | 0.020             | 13.                 | 600.                 | 10.5             | 0                    |
| 65 08 27 | 10.0                | 2.00           | 0.14                 | 0.06               | 0.025             | 13.                 | 576.                 | ---              | ---                  |
| 65 10 24 | 12.0                | 2.00           | 0.14                 | 0.06               | 0.025             | 13.                 | 576.                 | ---              | ---                  |
| 66 01 15 | 14.0                | 2.00           | 0.32                 | 0.11               | 0.015             | 15.                 | 693.                 | ---              | ---                  |

| DATE     | F-COLI<br>MPN/100 ML | SECCHI DISC<br>METRES |
|----------|----------------------|-----------------------|
| 65 07 03 | 0                    | 5.00                  |
| 65 07 09 | 0                    | 3.10                  |
| 65 07 16 | 0                    | 2.20                  |
| 65 07 23 | 0                    | 2.00                  |
| 65 07 30 | 0                    | 2.50                  |
| 65 08 07 | 0                    | 2.70                  |
| 65 08 14 | 0                    | 1.00                  |
| 65 08 20 | 0                    | 1.00                  |
| 65 08 27 | ---                  | 3.00                  |
| 65 10 24 | ---                  | ---                   |
| 66 01 15 | ---                  | ---                   |

Appendix IV(e-iii)

STATION M00944, SOURCE - SANDY LAKE  
SAMPLING LOCATION - S E END LATITUDE 50:32 LONGITUDE 100:10

FROM 85 06 01  
TO 86 01 31

| DATE     | COD<br>US/CM | T.R.<br>MG/L | F.R.<br>MG/L | H.F.R.<br>MG/L | PH<br>PH UNITS | ALKALINITY<br>MG/CAC03/L | ALKALINITY<br>MG/C03/L | ALKALINITY<br>MG/C03/L | ALKALINITY<br>MG/C03/L |
|----------|--------------|--------------|--------------|----------------|----------------|--------------------------|------------------------|------------------------|------------------------|
| 85 07 03 | 1560.0       | 1360.        | 1360.        | 5. L           | 8.40           | 326.                     | 334.                   | 31.                    | 0.                     |
| 85 07 09 | 1500.0       | 1350.        | 1350.        | 5. L           | 8.40           | 326.                     | 317.                   | 41.                    | 0.                     |
| 85 07 16 | 1500.0       | 1350.        | 1350.        | 5. L           | 8.40           | 326.                     | 324.                   | 41.                    | 0.                     |
| 85 07 23 | 1500.0       | 1350.        | 1350.        | 5. L           | 8.40           | 326.                     | 322.                   | 41.                    | 0.                     |
| 85 07 30 | 1500.0       | 1350.        | 1350.        | 5. L           | 8.40           | 326.                     | 322.                   | 41.                    | 0.                     |
| 85 08 07 | 1510.0       | 1360.        | 1360.        | 5. L           | 8.40           | 326.                     | 315.                   | 41.                    | 0.                     |
| 85 08 14 | 1510.0       | 1370.        | 1370.        | 5. L           | 8.40           | 310.                     | 365.                   | 35.                    | 0.                     |
| 85 08 20 | 1510.0       | 1360.        | 1360.        | 5. L           | 8.40           | 318.                     | 325.                   | 31.                    | 0.                     |
| 85 08 27 | 1540.0       | 1240.        | 1240.        | 5. L           | 8.40           | 326.                     | 339.                   | 29.                    | 0.                     |
| 85 10 24 | 1540.0       | 1260.        | 1260.        | 5. L           | 8.45           | 330.                     | 329.                   | 36.                    | 0.                     |
| 86 01 15 | 1620.0       | 1540.        | 1540.        | 5. L           | 8.35           | 390.                     | 476.                   | 5.                     | 0.                     |

| DATE     | CALCIUM<br>MG/CA/L | MAGNESIUM<br>MG/MG/L | HARDNESS<br>MG/CAC03/L | IRON<br>MG/FE/L | POTASSIUM<br>MG/K/L | SODIUM<br>MG/NA/L | DO<br>MG/O2/L | TURBIDITY<br>NTU |
|----------|--------------------|----------------------|------------------------|-----------------|---------------------|-------------------|---------------|------------------|
| 85 07 03 | 25.                | 194.                 | 861.                   | 0.03            | 41.                 | 31.               | 9.5           | 1.00             |
| 85 07 09 | 26.                | 190.                 | 847.                   | 0.04            | 39.                 | 36.               | 8.9           | 0.55             |
| 85 07 16 | 27.                | 200.                 | 890.                   | 0.04            | 39.                 | 31.               | 7.7           | 0.55             |
| 85 07 23 | 25.                | 194.                 | 844.                   | 0.03            | 40.                 | 35.               | 8.0           | 0.90             |
| 85 08 07 | 25.                | 200.                 | 891.                   | 0.03            | 43.                 | 31.               | 7.7           | 0.25             |
| 85 08 14 | 27.                | 211.                 | 918.                   | 0.07            | 43.                 | 30.               | 7.5           | 1.09             |
| 85 08 20 | 29.                | 215.                 | 918.                   | 0.03            | 41.                 | 35.               | 6.0           | 0.55             |
| 85 08 27 | 25.                | 174.                 | 778.                   | 0.04            | 40.                 | 31.               | 6.1           | 0.60             |
| 85 10 24 | 28.                | 182.                 | 819.                   | 0.02            | 43.                 | 31.               | 11.0          | 1.00             |
| 86 01 15 | 32.                | 191.                 | 862.                   | 0.05            | 44.                 | 33.               | 6.3           | 0.70             |

| DATE     | SILICA<br>MG/SIO2/L | TKN<br>MG/N/L | NO3 + NO2<br>MG/N/L | P-TOTAL<br>MG/P/L | CHLORIDE<br>MG/CL/L | SULPHATE<br>MG/SO4/L | CHLORO-A<br>US/L | T. COLI<br>MPN/100 ML |
|----------|---------------------|---------------|---------------------|-------------------|---------------------|----------------------|------------------|-----------------------|
| 85 07 03 | 6.1                 | 1.90          | 0.01                | 0.050             | 12.                 | 610.                 | 1.3              | 7                     |
| 85 07 09 | 5.8                 | 1.90          | 0.01                | 0.020             | 12.                 | 590.                 | 3.5              | 0                     |
| 85 07 16 | 6.1                 | 1.90          | 0.02                | 0.025             | 14.                 | 600.                 | 4.4              | 0                     |
| 85 07 23 | 6.0                 | 1.90          | 0.03                | 0.025             | 13.                 | 590.                 | 5.3              | 0                     |
| 85 07 30 | 6.2                 | 2.00          | 0.02                | 0.025             | 13.                 | 620.                 | 3.5              | 0                     |
| 85 08 07 | 6.1                 | 1.90          | 0.03                | 0.025             | 13.                 | 600.                 | 16.9             | 0                     |
| 85 08 14 | 9.3                 | 1.90          | 0.06                | 0.035             | 12.                 | 590.                 | 5.3              | 0                     |
| 85 08 20 | 9.7                 | 2.00          | 0.05                | 0.035             | 12.                 | 570.                 | 5.3              | 0                     |
| 85 08 27 | 9.7                 | 2.00          | 0.05                | 0.035             | 13.                 | 570.                 | 6.7              | 0                     |
| 85 10 24 | 12.0                | 2.00          | 0.12                | 0.025             | 13.                 | 590.                 | ---              | ---                   |
| 86 01 15 | 14.0                | 2.40          | 0.33                | 0.020             | 15.                 | 700.                 | ---              | ---                   |

| DATE     | F. COLI<br>MPN/100 ML | SECCHI DISC<br>METRES |
|----------|-----------------------|-----------------------|
| 85 07 03 | 4                     | 4.40                  |
| 85 07 09 | 0                     | 3.50                  |
| 85 07 16 | 0                     | 2.20                  |
| 85 07 23 | 0                     | 2.00                  |
| 85 07 30 | 0                     | 2.00                  |
| 85 08 07 | 0                     | 3.00                  |
| 85 08 14 | 9                     | 1.80                  |
| 85 08 20 | 0                     | 1.00                  |
| 85 08 27 | 0                     | 1.00                  |
| 85 10 24 | ---                   | 3.00                  |
| 86 01 15 | ---                   | ---                   |

Appendix IV(f-1)

STATION M9054, SOURCE - CRAWFORD LAKE  
SAMPLING LOCATION - W END LATITUDE 50:31 LONGITUDE 100:16

FROM 85 06 01  
TO 86 01 31

| DATE     | COND<br>US/CM | T.R.<br>MG/L | P.R.<br>MG/L | M.F.R.<br>MG/L | PH<br>UNITS | ALKALINITY<br>MG(CACO3)/L | ALKALINITY<br>MG(CO3)/L | ALKALINITY<br>MG(OH)/L |
|----------|---------------|--------------|--------------|----------------|-------------|---------------------------|-------------------------|------------------------|
| 85 07 03 | 2730.0        | 2478.        | 2478.        | 5. L           | 8.95        | 438.                      | 427.                    | 53.                    |
| 85 07 06 | 2740.0        | 2480.        | 2480.        | 5. L           | 8.90        | 448.                      | 415.                    | 65.                    |
| 85 07 16 | 2770.0        | 2590.        | 2590.        | 12.            | 9.00        | 446.                      | 393.                    | 78.                    |
| 85 07 23 | 2790.0        | 2468.        | 2450.        | 7.             | 8.95        | 450.                      | 407.                    | 70.                    |
| 85 07 30 | 2770.0        | 2470.        | 2460.        | 6.             | 9.00        | 446.                      | 403.                    | 70.                    |
| 85 08 07 | 2650.0        | 2420.        | 2420.        | 5. L           | 9.00        | 430.                      | 376.                    | 72.                    |
| 85 08 14 | 2630.0        | 2400.        | 2400.        | 5. L           | 8.90        | 422.                      | 378.                    | 67.                    |
| 85 08 20 | 2610.0        | 2380.        | 2360.        | 5. L           | 9.00        | 422.                      | 375.                    | 69.                    |
| 85 08 26 | 2610.0        | 2360.        | 2360.        | 5. L           | 8.95        | 428.                      | 353.                    | 65.                    |
| 85 10 23 | 2620.0        | 2450.        | 2450.        | 5. L           | 8.95        | 428.                      | 350.                    | 65.                    |
| 86 01 15 | 2870.0        | 2620.        | 2620.        | 5. L           | 8.85        | 402.                      | 476.                    | 55.                    |

| DATE     | CALCIUM<br>MG/L | MAGNESIUM<br>MG/L | HARDNESS<br>MG(CACO3)/L | MANGANESE<br>MG/L | IRON<br>MG/L | POTASSIUM<br>MG/L | SODIUM<br>MG/L | DO<br>MG/L | TURBIDITY<br>NTU |
|----------|-----------------|-------------------|-------------------------|-------------------|--------------|-------------------|----------------|------------|------------------|
| 85 07 03 | 30.             | 330.              | 1430.                   | 0.05              | 0.07         | 52.               | 142.           | 10.0       | 1.00             |
| 85 07 06 | 34.             | 350.              | 1526.                   | 0.03              | 0.04         | 52.               | 168.           | 9.4        | 1.00             |
| 85 07 16 | 29.             | 300.              | 1310.                   | 0.03              | 0.05         | 55.               | 159.           | 9.2        | 0.50             |
| 85 07 23 | 30.             | 320.              | 1392.                   | 0.04              | 0.05         | 53.               | 156.           | 8.4        | 7.50             |
| 85 07 30 | 28.             | 360.              | 1634.                   | 0.03              | 0.04         | 58.               | 150.           | 8.3        | 4.00             |
| 85 08 07 | 27.             | 342.              | 1474.                   | 0.03              | 0.07         | 58.               | 162.           | 6.9        | 1.50             |
| 85 08 14 | 26.             | 340.              | 1469.                   | 0.05              | 0.07         | 55.               | 162.           | 6.9        | 0.75             |
| 85 08 20 | 28.             | 320.              | 1300.                   | 0.07              | 0.02 L       | 55.               | 157.           | 9.6        | 0.75             |
| 85 08 26 | 20.             | 334.              | 1444.                   | 0.07              | 0.02         | 56.               | 150.           | 8.6        | 0.45             |
| 85 10 23 | 30.             | 350.              | 1530.                   | 0.02              | 0.09         | 56.               | 140.           | 10.7       | 1.50             |
| 86 01 15 | 30.             | 330.              | 1430.                   | 0.04              | 0.06         | 53.               | 152.           | 7.2        | 0.70             |

| DATE     | SILICA<br>MG/SIO2/L | TKN<br>MG/L | 1403 + 1404<br>MG/L | NO3-NO2<br>MG/L | P-TOTAL<br>MG/L | CHLORIDE<br>MG/L | SULPHATE<br>MG/L | CHLORO-A<br>US/L | T. COLI<br>MPN/100 ML |
|----------|---------------------|-------------|---------------------|-----------------|-----------------|------------------|------------------|------------------|-----------------------|
| 85 07 03 | 0.3                 | 2.20        | 0.01                | 0.01 L          | 0.000           | 25.              | 1200.            | 4.4              | 0                     |
| 85 07 06 | 0.4                 | 2.40        | 0.03                | 0.01 L          | 0.000           | 26.              | 1200.            | 2.9              | 43                    |
| 85 07 16 | 0.5                 | 2.10        | 0.01                | 0.01 L          | 0.030           | 28.              | 1200.            | 4.0              | 0                     |
| 85 07 23 | 0.8                 | 2.15        | 0.02                | 0.01 L          | 0.030           | 26.              | 1100.            | 2.2              | 0                     |
| 85 07 30 | 1.4                 | 2.20        | 0.01                | 0.01 L          | 0.030           | 25.              | 1350.            | 2.9              | 0                     |
| 85 08 07 | 2.6                 | 2.00        | 0.02                | 0.01 L          | 0.035           | 25.              | 1500.            | 3.5              | 4                     |
| 85 08 14 | 3.2                 | 2.00        | 0.04                | 0.01 L          | 0.040           | 25.              | 1325.            | 1.3              | 0                     |
| 85 08 20 | 3.0                 | 2.00        | 0.03                | 0.01 L          | 0.040           | 26.              | 1275.            | 3.5              | 0                     |
| 85 08 26 | 3.0                 | 2.00        | 0.01                | 0.01 L          | 0.035           | 25.              | 1765.            | 6.1              | 4                     |
| 85 10 23 | 0.5                 | 2.10        | 0.01                | 0.01 L          | 0.030           | 25.              | 1300.            | ---              | ---                   |
| 86 01 15 | 1.4                 | 2.40        | 0.06                | 0.01            | 0.025           | 29.              | 1300.            | ---              | ---                   |

| DATE     | F. COLI<br>MPN/100 ML | SECCO DISC<br>METRES |
|----------|-----------------------|----------------------|
| 85 07 03 | 0                     | 2.70                 |
| 85 07 06 | 15                    | 3.00                 |
| 85 07 16 | 0                     | 2.70                 |
| 85 07 23 | 0                     | 3.10                 |
| 85 07 30 | 0                     | 2.90                 |
| 85 08 07 | 0                     | 3.40                 |
| 85 08 14 | 0                     | 3.40                 |
| 85 08 20 | 0                     | 2.40                 |
| 85 08 26 | 0                     | 2.20                 |
| 85 10 23 | ---                   | 3.00                 |
| 86 01 15 | ---                   | ---                  |

Appendix IV(f-11)

STATION M0855, SOURCE - CRAWFORD LAKE  
SAMPLING LOCATION - MIDDLE LATITUDE 50:31 LONGITUDE 100:16

FROM 05 06 01  
TO 06 01 31

| DATE     | COND<br>US/CM | T.R.<br>MG/L | F.R.<br>MG/L | H.F.R.<br>MG/L | PH<br>UNITS | ALKALINITY<br>MG(CACO3)/L | ALKALINITY<br>MG(CACO3)/L | ALKALINITY<br>MG(CACO3)/L | ALKALINITY<br>MG(CACO3)/L |
|----------|---------------|--------------|--------------|----------------|-------------|---------------------------|---------------------------|---------------------------|---------------------------|
| 05 07 03 | 2710.0        | 2570.        | 2570.        | 5. L           | 8.55        | 440.                      | 425.                      | 55.                       | 0.                        |
| 05 07 09 | ---           | ---          | ---          | ---            | ---         | ---                       | ---                       | ---                       | ---                       |
| 05 07 16 | 2770.0        | 2530.        | 2520.        | 10.            | 8.95        | 452.                      | 400.                      | 74.                       | 0.                        |
| 05 07 23 | 2600.0        | 2500.        | 2490.        | 6.             | 9.05        | 446.                      | 407.                      | 67.                       | 0.                        |
| 05 07 30 | 2750.0        | 2490.        | 2490.        | 9.             | 8.95        | 440.                      | 410.                      | 67.                       | 0.                        |
| 05 08 07 | 2600.0        | 2440.        | 2440.        | 5. L           | 9.00        | 440.                      | 400.                      | 67.                       | 0.                        |
| 05 08 14 | 2610.0        | 2400.        | 2400.        | 5. L           | 9.00        | 416.                      | 378.                      | 62.                       | 0.                        |
| 05 08 21 | 2570.0        | 2300.        | 2300.        | 5. L           | 8.95        | 426.                      | 393.                      | 62.                       | 0.                        |
| 05 08 28 | 2570.0        | 2300.        | 2300.        | 5. L           | 9.15        | 426.                      | 376.                      | 72.                       | 0.                        |
| 05 08 35 | 2450.0        | 2300.        | 2300.        | 5. L           | 9.00        | 430.                      | 407.                      | 60.                       | 0.                        |
| 06 01 15 | 2440.0        | 2670.        | 2670.        | 5. L           | 9.00        | 460.                      | 460.                      | 59.                       | 0.                        |

| DATE     | CALCIUM<br>MG(CA)/L | MAGNESIUM<br>MG(MG)/L | HARDNESS<br>MG(CACO3)/L | MANGANESE<br>MG(MN)/L | IRON<br>MG(Fe)/L | POTASSIUM<br>MG(K)/L | SODIUM<br>MG(Na)/L | DO<br>MG(O2)/L | TURBIDITY<br>NTU |
|----------|---------------------|-----------------------|-------------------------|-----------------------|------------------|----------------------|--------------------|----------------|------------------|
| 05 07 03 | 30.                 | 326.                  | 1420.                   | 0.04                  | 0.06             | 51.                  | 146.               | 9.6            | 1.00             |
| 05 07 09 | ---                 | ---                   | ---                     | ---                   | ---              | ---                  | ---                | 9.2            | ---              |
| 05 07 16 | 30.                 | 320.                  | 1392.                   | 0.03                  | 0.05             | 53.                  | 146.               | 8.2            | 5.50             |
| 05 07 23 | 32.                 | 354.                  | 1535.                   | 0.03                  | 0.04             | 52.                  | 146.               | 6.7            | 5.50             |
| 05 07 30 | 28.                 | 320.                  | 1367.                   | 0.03                  | 0.04             | 53.                  | 146.               | 7.9            | 5.00             |
| 05 08 07 | 28.                 | 302.                  | 1312.                   | 0.14                  | 0.04             | 59.                  | 152.               | 7.3            | 1.50             |
| 05 08 14 | 28.                 | 344.                  | 1560.                   | 0.05                  | 0.07             | 57.                  | 146.               | 6.3            | 0.95             |
| 05 08 21 | 27.                 | 314.                  | 1360.                   | 0.03                  | 0.05             | 55.                  | 150.               | 7.6            | 0.90             |
| 05 08 28 | 27.                 | 324.                  | 1403.                   | 0.03                  | 0.02 L           | 54.                  | 153.               | 6.2            | 0.50             |
| 05 08 35 | 31.                 | 370.                  | 1600.                   | 0.02                  | 0.09             | 56.                  | 160.               | 11.0           | 1.50             |
| 06 01 15 | 29.                 | 320.                  | 1390.                   | 0.05                  | 0.06             | 53.                  | 149.               | 6.8            | 0.60             |

| DATE     | SILICA<br>MG(SIO2)/L | TEN<br>MG(MN)/L | NH3 + NH4<br>MG(N)/L | NO3-NO2<br>MG(N)/L | P-TOTAL<br>MG(P)/L | CHLORIDE<br>MG(CL)/L | SULPHATE<br>MG(SO4)/L | CHLORO-A<br>UG/L | T. COLI<br>MPN/100 ML |
|----------|----------------------|-----------------|----------------------|--------------------|--------------------|----------------------|-----------------------|------------------|-----------------------|
| 05 07 03 | 6.2                  | 2.10            | 0.01                 | 0.01 L             | 0.030              | 25.                  | 800.                  | 3.5              | 0                     |
| 05 07 09 | ---                  | ---             | ---                  | ---                | ---                | ---                  | ---                   | ---              | 0                     |
| 05 07 16 | 6.5                  | 2.20            | 0.04                 | 0.01 L             | 0.035              | 26.                  | 1200.                 | 3.5              | 0                     |
| 05 07 23 | 6.6                  | 2.00            | 0.02                 | 0.01 L             | 0.030              | 26.                  | 1300.                 | 1.6              | 0                     |
| 05 07 30 | 1.3                  | 2.10            | 0.01                 | 0.01 L             | 0.030              | 26.                  | 1350.                 | 3.1              | 0                     |
| 05 08 07 | 2.6                  | 2.10            | 0.01                 | 0.01 L             | 0.050              | 28.                  | 1100.                 | 3.9              | 0                     |
| 05 08 14 | 2.6                  | 2.00            | 0.04                 | 0.01 L             | 0.040              | 25.                  | 1100.                 | 2.6              | 23                    |
| 05 08 21 | 3.2                  | 2.00            | 0.04                 | 0.01 L             | 0.040              | 26.                  | 1275.                 | 5.3              | 0                     |
| 05 08 28 | 3.6                  | 2.10            | 0.01                 | 0.01 L             | 0.045              | 25.                  | 1275.                 | 5.3              | 0                     |
| 05 10 23 | 6.7                  | 2.20            | 0.01                 | 0.01 L             | 0.035              | 25.                  | 1350.                 | ---              | ---                   |
| 06 01 15 | 1.6                  | 2.50            | 0.06                 | 0.02               | 0.030              | 29.                  | 1350.                 | ---              | ---                   |

| DATE     | F. COLI<br>MPN/100 ML | SECCI DISC<br>METRES |
|----------|-----------------------|----------------------|
| 05 07 03 | 0                     | 2.78                 |
| 05 07 09 | 0                     | 3.40                 |
| 05 07 16 | 0                     | 3.00                 |
| 05 07 23 | 0                     | 3.00                 |
| 05 07 30 | 0                     | 3.00                 |
| 05 08 07 | 0                     | 3.20                 |
| 05 08 14 | 4                     | 3.10                 |
| 05 08 21 | 0                     | 2.90                 |
| 05 08 28 | 0                     | 2.60                 |
| 05 10 23 | ---                   | 2.00                 |
| 06 01 15 | ---                   | ---                  |

Appendix IV(f-iii)

STATION 100954, SOURCE - CRAWFORD LAKE  
SAMPLING LOCATION - E END LATITUDE 50°31' LONGITUDE 100°16'

FROM 05 06 01  
TO 06 01 31

| DATE     | COD<br>US/CH | T.R.<br>MG/L | F.R.<br>MG/L | H.F.R.<br>MG/L | PH<br>UNITS | ALKALINITY<br>MG(CO3)/L | ALKALINITY<br>MG(CO3)/L | ALKALINITY<br>MG(CO3)/L | ALKALINITY<br>MG(CO3)/L |
|----------|--------------|--------------|--------------|----------------|-------------|-------------------------|-------------------------|-------------------------|-------------------------|
| 05 07 03 | 2710.0       | 2480.        | 2480.        | 5. L           | 8.95        | 438.                    | 412.                    | 40.                     | 0.                      |
| 05 07 09 | ---          | ---          | ---          | ---            | ---         | ---                     | ---                     | ---                     | ---                     |
| 05 07 16 | 2790.0       | 2420.        | 2420.        | 5. L           | 8.95        | 452.                    | 425.                    | 62.                     | 0.                      |
| 05 07 23 | 2790.0       | 2440.        | 2440.        | 5. L           | 9.00        | 448.                    | 415.                    | 62.                     | 0.                      |
| 05 07 30 | 2800.0       | 2440.        | 2440.        | 5. L           | 8.95        | 448.                    | 400.                    | 72.                     | 0.                      |
| 05 08 07 | 2810.0       | 2410.        | 2410.        | 5. L           | 9.05        | 432.                    | 391.                    | 72.                     | 0.                      |
| 05 08 14 | 2830.0       | 2440.        | 2440.        | 5. L           | 8.95        | 416.                    | 371.                    | 67.                     | 0.                      |
| 05 08 20 | 2840.0       | 2360.        | 2360.        | 5. L           | 9.00        | 420.                    | 361.                    | 65.                     | 0.                      |
| 05 08 26 | 2870.0       | 2380.        | 2380.        | 5. L           | 8.95        | 420.                    | 376.                    | 72.                     | 0.                      |
| 05 10 23 | 2650.0       | 2460.        | 2460.        | 5. L           | 8.95        | 432.                    | 326.                    | 70.                     | 0.                      |
| 06 01 15 | 2820.0       | 2650.        | 2650.        | 5. L           | 8.80        | 462.                    | 471.                    | 50.                     | 0.                      |

| DATE     | CALCIUM<br>MG(CA)/L | MAGNESIUM<br>MG(MG)/L | HARDNESS<br>MG(CA+MG)/L | MANGANESE<br>MG(MN)/L | IRON<br>MG(Fe)/L | POTASSIUM<br>MG(K)/L | SODIUM<br>MG(Na)/L | DO<br>MG(O2)/L | TURBIDITY<br>NTU |
|----------|---------------------|-----------------------|-------------------------|-----------------------|------------------|----------------------|--------------------|----------------|------------------|
| 05 07 03 | 30.                 | 324.                  | 1410.                   | 0.04                  | 0.07             | 51.                  | 143.               | 9.4            | 1.50             |
| 05 07 09 | ---                 | ---                   | ---                     | ---                   | ---              | ---                  | ---                | 9.5            | ---              |
| 05 07 16 | 29.                 | 360.                  | 1310.                   | 0.05                  | 0.14             | 53.                  | 160.               | 7.4            | 1.50             |
| 05 07 23 | 26.                 | 360.                  | 1397.                   | 0.03                  | 0.15             | 54.                  | 166.               | 6.0            | 7.50             |
| 05 07 30 | 27.                 | 282.                  | 1220.                   | 0.04                  | 0.15             | 53.                  | 140.               | 7.6            | 2.50             |
| 05 08 07 | 27.                 | 360.                  | 1466.                   | 0.05                  | 0.27             | 57.                  | 152.               | 8.4            | 1.50             |
| 05 08 14 | 28.                 | 360.                  | 1551.                   | 0.04                  | 0.27             | 57.                  | 169.               | 8.4            | 0.60             |
| 05 08 20 | 28.                 | 330.                  | 1430.                   | 0.04                  | 0.05             | 56.                  | 153.               | 8.3            | 0.20             |
| 05 08 26 | 27.                 | 320.                  | 1393.                   | 0.04                  | 0.02             | 53.                  | 148.               | 10.0           | 1.50             |
| 05 10 23 | 32.                 | 360.                  | 1644.                   | 0.02                  | 0.07             | 50.                  | 167.               | 7.4            | 0.75             |
| 06 01 15 | 30.                 | 316.                  | 1380.                   | 0.06                  | 0.07             | 50.                  | 167.               | 7.4            | 0.75             |

| DATE     | SILICA<br>MG(SIO2)/L | TEM<br>MG(MN)/L | ML3 + ML4<br>MG(MN)/L | NO3-NO2<br>MG(N)/L | P-TOTAL<br>MG(P)/L | CHLORIDE<br>MG(CL)/L | SULPHATE<br>MG(SO4)/L | CHLORO-A<br>US/L | T-COLI<br>MG/100 ML |
|----------|----------------------|-----------------|-----------------------|--------------------|--------------------|----------------------|-----------------------|------------------|---------------------|
| 05 07 03 | 0.2                  | 2.10            | 0.01                  | 0.01 L             | 0.030              | 25.                  | 800.                  | 2.6              | 4                   |
| 05 07 09 | ---                  | ---             | ---                   | ---                | ---                | ---                  | ---                   | ---              | 0                   |
| 05 07 16 | 1.0                  | 2.20            | 0.03                  | 0.01 L             | 0.010              | 26.                  | 1200.                 | 3.5              | 0                   |
| 05 07 23 | 0.8                  | 2.00            | 0.01                  | 0.01 L             | 0.010              | 26.                  | 1100.                 | 3.5              | 0                   |
| 05 07 30 | 2.4                  | 2.10            | 0.01                  | 0.01 L             | 0.010              | 26.                  | 1100.                 | 1.8              | 43                  |
| 05 08 07 | 1.6                  | 2.10            | 0.01                  | 0.01 L             | 0.010              | 25.                  | 1270.                 | 2.6              | 9                   |
| 05 08 14 | 2.7                  | 2.10            | 0.01                  | 0.01 L             | 0.010              | 25.                  | 1318.                 | 1.8              | 9                   |
| 05 08 20 | 3.2                  | 2.10            | 0.03                  | 0.01 L             | 0.010              | 26.                  | 1278.                 | 5.7              | 4                   |
| 05 08 26 | 3.3                  | 2.10            | 0.01                  | 0.01 L             | 0.010              | 25.                  | 1265.                 | 4.4              | 15                  |
| 05 10 23 | 1.6                  | 2.20            | 0.01                  | 0.01 L             | 0.030              | 25.                  | 1330.                 | ---              | ---                 |
| 06 01 15 | 1.6                  | 2.40            | 0.07                  | 0.03               | 0.030              | 29.                  | 1370.                 | ---              | ---                 |

| DATE     | F-COLI<br>MG/100 ML | SECCCHI DISC<br>METRES |
|----------|---------------------|------------------------|
| 05 07 03 | 0                   | 2.70                   |
| 05 07 09 | 0                   | 2.90                   |
| 05 07 16 | 0                   | 2.90                   |
| 05 07 23 | 0                   | 3.80                   |
| 05 07 30 | 0                   | 3.70                   |
| 05 08 07 | 0                   | 3.30                   |
| 05 08 14 | 0                   | 2.60                   |
| 05 08 20 | 0                   | 2.50                   |
| 05 08 26 | 4                   | 1.90                   |
| 05 10 23 | ---                 | 2.60                   |
| 06 01 15 | ---                 | ---                    |

Appendix IV(g-i)

STATION HQ951, SOURCE - THOMAS LAKE  
SAMPLING LOCATION - W END LATITUDE 50:35 LONGITUDE 100:15

FROM 05 06 01  
TO 06 01 31

| DATE     | COND<br>US/CM | T.R.<br>MG/L | F.R.<br>MG/L | H.P.R.<br>MG/L | PH<br>UNITS | ALKALINITY<br>MG/CAC03/L | ALKALINITY<br>MG/CA03/L | ALKALINITY<br>MG/CO3/L | ALKALINITY<br>MG/CO3/L |
|----------|---------------|--------------|--------------|----------------|-------------|--------------------------|-------------------------|------------------------|------------------------|
| 05 07 03 | 1700.0        | 1510.        | 1510.        | S. L           | 8.40        | 342.                     | 346.                    | 34.                    | 0.                     |
| 05 07 10 | 1790.0        | 1500.        | 1500.        | S. L           | 8.95        | 346.                     | 352.                    | 41.                    | 0.                     |
| 05 07 17 | 1800.0        | 1470.        | 1470.        | S. L           | 9.15        | 340.                     | 327.                    | 55.                    | 0.                     |
| 05 07 24 | 1820.0        | 1540.        | 1540.        | S. L           | 8.65        | 340.                     | 351.                    | 13.                    | 0.                     |
| 05 07 31 | 1850.0        | 1530.        | 1520.        | 6. L           | 8.90        | 344.                     | 346.                    | 40.                    | 0.                     |
| 05 08 08 | 1740.0        | 1499.        | 1400.        | 6. L           | 8.90        | 340.                     | 346.                    | 46.                    | 0.                     |
| 05 08 15 | 1720.0        | 1490.        | 1490.        | S. L           | 8.65        | 354.                     | 351.                    | 41.                    | 0.                     |
| 05 08 21 | 1690.0        | 1520.        | 1520.        | S. L           | 8.90        | 348.                     | 346.                    | 35.                    | 0.                     |
| 05 08 27 | 1700.0        | 1430.        | 1430.        | S. L           | 6.95        | 354.                     | 349.                    | 41.                    | 0.                     |
| 05 10 24 | 1700.0        | 1440.        | 1460.        | S. L           | 6.95        | 354.                     | 334.                    | 46.                    | 0.                     |
| 06 01 14 | 1940.0        | 1640.        | 1640.        | S. L           | 8.65        | 392.                     | 418.                    | 31.                    | 0.                     |

| DATE     | CALCIUM<br>MG/CA/L | MAGNESIUM<br>MG/MG/L | HARDNESS<br>MG/CAC03/L | MANGANESE<br>MG/MN/L | IRON<br>MG/FE/L | POTASSIUM<br>MG/K/L | SODIUM<br>MG/NA/L | DD<br>MG/02/L | TURBIDITY<br>NTU |
|----------|--------------------|----------------------|------------------------|----------------------|-----------------|---------------------|-------------------|---------------|------------------|
| 05 07 03 | 35.                | 213.                 | 965.                   | 0.03                 | 0.06            | 45.                 | 52.               | 8.0           | 1.00             |
| 05 07 10 | 33.                | 209.                 | 943.                   | 0.02                 | 0.03            | 43.                 | 51.               | 6.1           | 110.00           |
| 05 07 17 | 33.                | 200.                 | 900.                   | 0.04                 | 0.04            | 45.                 | 51.               | 6.3           | 1.02             |
| 05 07 24 | 31.                | 199.                 | 897.                   | 0.05                 | 0.04            | 44.                 | 53.               | 7.7           | 0.90             |
| 05 07 31 | 32.                | 206.                 | 919.                   | 0.05                 | 0.07            | 44.                 | 55.               | 9.0           | 1.00             |
| 05 08 08 | 33.                | 225.                 | 1009.                  | 0.04                 | 0.08            | 46.                 | 54.               | 7.0           | 3.00             |
| 05 08 15 | 33.                | 232.                 | 1040.                  | 0.03                 | 0.05            | 56.                 | 57.               | 7.6           | 1.00             |
| 05 08 21 | 30.                | 211.                 | 922.                   | 0.03                 | 0.05            | 45.                 | 49.               | 6.6           | 0.90             |
| 05 08 27 | 31.                | 218.                 | 929.                   | 0.04                 | 0.04            | 45.                 | 52.               | 11.4          | 0.75             |
| 05 10 24 | 30.                | 207.                 | 895.                   | 0.02                 | 0.01            | 45.                 | 52.               | 11.4          | 1.03             |
| 06 01 14 | 25.                | 164.                 | 747.                   | 0.02                 | 0.02 L          | 40.                 | 51.               | 9.0           | 0.50             |

| DATE     | SILICA<br>MG/SIO2/L | TRM<br>MG/H/L | NO3 + NO2<br>MG/N/L | P-TOTAL<br>MG/P/L | CHLORIDE<br>MG/CL/L | SULFATE<br>MG/SO4/L | CHLORO-A<br>US/L | T. COLI<br>MPN/100 ML |
|----------|---------------------|---------------|---------------------|-------------------|---------------------|---------------------|------------------|-----------------------|
| 05 07 03 | 5.2                 | 1.70          | 0.02                | 0.030             | 11.                 | 710.                | 3.5              | 0                     |
| 05 07 10 | 4.9                 | 1.60          | 0.01                | 0.01 L            | 11.                 | 725.                | 9.7              | 0                     |
| 05 07 17 | 5.0                 | 1.70          | 0.02                | 0.020             | 10.                 | 715.                | 9.4              | ---                   |
| 05 07 24 | 5.2                 | 1.70          | 0.01                | 0.01 L            | 12.                 | 775.                | 5.3              | 0                     |
| 05 07 31 | 6.2                 | 1.80          | 0.01                | 0.01 L            | 12.                 | 775.                | 2.3              | 4                     |
| 05 08 08 | 5.6                 | 1.70          | 0.01                | 0.01 L            | 11.                 | 690.                | 9.6              | 23                    |
| 05 08 15 | 7.0                 | 1.70          | 0.02                | 0.01 L            | 12.                 | 750.                | 5.3              | 43                    |
| 05 08 21 | 7.0                 | 1.70          | 0.03                | 0.01 L            | 11.                 | 740.                | 6.1              | 7                     |
| 05 08 27 | 6.4                 | 1.70          | 0.01                | 0.020             | 12.                 | 715.                | 3.9              | 4                     |
| 05 10 24 | 6.4                 | 1.70          | 0.00 L              | 0.020             | 11.                 | 725.                | ---              | ---                   |
| 06 01 14 | 6.7                 | 1.90          | 0.05                | 0.020             | 13.                 | 815.                | ---              | ---                   |

| DATE     | F. COLI<br>MPN/100 ML | SECCHI DISC<br>FETTES |
|----------|-----------------------|-----------------------|
| 05 07 03 | 0                     | 3.50                  |
| 05 07 10 | 0                     | 3.30                  |
| 05 07 17 | ---                   | 3.60                  |
| 05 07 24 | 0                     | 2.30                  |
| 05 07 31 | 0                     | 1.70                  |
| 05 08 08 | 9                     | 1.90                  |
| 05 08 15 | 15                    | 2.00                  |
| 05 08 21 | 3                     | 2.00                  |
| 05 08 27 | 4                     | 3.00                  |
| 05 10 24 | ---                   | 3.50                  |
| 06 01 14 | ---                   | ---                   |

Appendix IV(g-11)

STATION 140962, SOURCE - THOMAS LAKE  
SAMPLING LOCATION - 3 M MIDDLE LATITUDE 50.35 LONGITUDE 100.15

FROM 05 06 01  
TO 06 01 31

| DATE     | COND<br>US/CM | T.R.<br>MG/L | F.R.<br>MG/L | N.F.R.<br>MG/L | PH UNITS | ALP/ALINITY<br>MG(CACO3)/L | ALP/ALINITY<br>MG(HCO3)/L | ALP/ALINITY<br>MG(CO3)/L | ALP/ALINITY<br>MG(OH)/L |
|----------|---------------|--------------|--------------|----------------|----------|----------------------------|---------------------------|--------------------------|-------------------------|
| 05 07 03 | 1790.0        | 1540.        | 1540.        | 5. L           | 0.50     | 366.                       | 371.                      | 35.                      | 0.                      |
| 05 07 10 | 1790.0        | 1460.        | 1460.        | 5. L           | 0.55     | 366.                       | 359.                      | 43.                      | 0.                      |
| 05 07 17 | 1680.0        | 1490.        | 1490.        | 5. L           | 0.55     | 366.                       | 339.                      | 50.                      | 0.                      |
| 05 07 24 | 1630.0        | 1540.        | 1540.        | 5. L           | 0.55     | 366.                       | 371.                      | 38.                      | 0.                      |
| 05 07 31 | 1540.0        | 1550.        | 1540.        | 6. L           | 0.60     | 356.                       | 359.                      | 43.                      | 0.                      |
| 05 08 08 | 1740.0        | 1460.        | 1460.        | 5. L           | 0.60     | 356.                       | 356.                      | 38.                      | 0.                      |
| 05 08 15 | 1720.0        | 1500.        | 1500.        | 5. L           | 0.60     | 356.                       | 359.                      | 35.                      | 0.                      |
| 05 08 21 | 1710.0        | 1510.        | 1510.        | 5. L           | 0.55     | 356.                       | 339.                      | 43.                      | 0.                      |
| 05 08 27 | 1700.0        | 1470.        | 1470.        | 5. L           | 0.60     | 356.                       | 359.                      | 53.                      | 0.                      |
| 05 10 24 | 1710.0        | 1470.        | 1470.        | 5. L           | 0.60     | 356.                       | 359.                      | 53.                      | 0.                      |
| 06 01 14 | 1520.0        | 1440.        | 1440.        | 5. L           | 0.70     | 336.                       | 412.                      | 30.                      | 0.                      |

| DATE     | CALCIUM<br>MG(CA)/L | MAGNESIUM<br>MG(MG)/L | HARDNESS<br>MG(CACO3)/L | MANGANESE<br>MG(MN)/L | IRON<br>MG(Fe)/L | POTASSIUM<br>MG(K)/L | SODIUM<br>MG(Na)/L | DO<br>MG(O2)/L | TURBIDITY<br>NTU |
|----------|---------------------|-----------------------|-------------------------|-----------------------|------------------|----------------------|--------------------|----------------|------------------|
| 05 07 03 | 35.                 | 212.                  | 959.                    | 0.03                  | 0.05             | 45.                  | 51.                | 9.9            | 1.00             |
| 05 07 10 | 33.                 | 200.                  | 939.                    | 0.03                  | 0.03             | 45.                  | 49.                | 9.0            | 0.92             |
| 05 07 17 | 30.                 | 200.                  | 900.                    | 0.03                  | 0.04             | 45.                  | 50.                | 8.3            | 0.70             |
| 05 07 24 | 33.                 | 205.                  | 926.                    | 0.05                  | 0.05             | 45.                  | 55.                | 7.5            | 1.02             |
| 05 07 31 | 31.                 | 201.                  | 900.                    | 0.05                  | 0.05             | 45.                  | 54.                | 6.5            | 1.00             |
| 05 08 08 | 33.                 | 212.                  | 1007.                   | 0.04                  | 0.04             | 47.                  | 53.                | 6.0            | 1.00             |
| 05 08 15 | 33.                 | 217.                  | 1060.                   | 0.03                  | 0.04             | 47.                  | 59.                | 7.0            | 1.00             |
| 05 08 21 | 30.                 | 213.                  | 953.                    | 0.03                  | 0.04             | 46.                  | 50.                | 9.1            | 0.70             |
| 05 08 27 | 30.                 | 194.                  | 874.                    | 0.04                  | 0.04             | 44.                  | 53.                | 7.7            | 0.75             |
| 05 10 24 | 33.                 | 235.                  | 1050.                   | 0.02                  | 0.06             | 47.                  | 55.                | 13.3           | 1.03             |
| 06 01 14 | 26.                 | 167.                  | 751.                    | 0.02                  | 0.02 L           | 40.                  | 52.                | 9.6            | 0.50             |

| DATE     | SILICE<br>MG(SIO2)/L | TKN<br>MG(N)/L | 1003 + 1004<br>MG(N)/L | NO3-NO2<br>MG(N)/L | P-TOTAL<br>MG(P)/L | CHLORIDE<br>MG(CL)/L | SULPHATE<br>MG(SO4)/L | CHLORO-A<br>UG/L | T. COLI<br>MPN/100 ML |
|----------|----------------------|----------------|------------------------|--------------------|--------------------|----------------------|-----------------------|------------------|-----------------------|
| 05 07 03 | 5.1                  | 1.80           | 0.01                   | 0.01 L             | 0.020              | 11.                  | 715.                  | 4.4              | 23                    |
| 05 07 10 | 4.9                  | 1.80           | 0.01                   | 0.01 L             | 0.020              | 11.                  | 725.                  | 4.7              | 0                     |
| 05 07 17 | 5.0                  | 1.70           | 0.02                   | 0.01 L             | 0.020              | 10.                  | 725.                  | 4.4              | ---                   |
| 05 07 24 | 5.5                  | 1.70           | 0.01                   | 0.01 L             | 0.025              | 11.                  | 765.                  | 2.6              | 0                     |
| 05 07 31 | 6.2                  | 1.70           | 0.01                   | 0.01 L             | 0.025              | 12.                  | 775.                  | 2.6              | 4                     |
| 05 08 08 | 6.4                  | 1.70           | 0.01                   | 0.01 L             | 0.025              | 12.                  | 670.                  | 2.9              | 23                    |
| 05 08 15 | 7.0                  | 1.60           | 0.01                   | 0.01 L             | 0.025              | 12.                  | 765.                  | 3.9              | 23                    |
| 05 08 21 | 6.7                  | 1.70           | 0.02                   | 0.01 L             | 0.025              | 11.                  | 765.                  | 3.1              | 170                   |
| 05 08 27 | 7.2                  | 1.60           | 0.00                   | 0.01 L             | 0.025              | 11.                  | 725.                  | 3.9              | ---                   |
| 05 10 24 | 6.3                  | 1.70           | 0.00                   | 0.01 L             | 0.015              | 12.                  | 725.                  | ---              | ---                   |
| 06 01 14 | 6.7                  | 2.00           | 0.06                   | 0.01               | 0.015              | 13.                  | 825.                  | ---              | ---                   |

F. COLI  
MPN/100 ML

SECCIM DISC

METRES

DATE

05 07 03

05 07 10

05 07 17

05 07 24

05 07 31

05 08 08

05 08 15

05 08 21

05 08 27

05 10 24

06 01 14

Appendix IV(g-iii)

STATION M00953, SOURCE - THOMAS LAKE  
SAMPLING LOCATION - E END LATITUDE 50:35 LONGITUDE 100:15

FROM 05 04 01  
TO 06 01 31

| DATE     | COD<br>US/CM | T.R.<br>MG/L | F.R.<br>MG/L | H.F.R.<br>MG/L | PH<br>UNITS | ALPALKINITY<br>MG/CAC3/L | ALPALKINITY<br>MG/CAC3/L | ALPALKINITY<br>MG/CAC3/L | ALPALKINITY<br>MG/CM/L |
|----------|--------------|--------------|--------------|----------------|-------------|--------------------------|--------------------------|--------------------------|------------------------|
| 05 07 03 | 1760.0       | 1610.        | 1610.        | S. L           | 8.80        | 366.                     | 366.                     | 39.                      | 0.                     |
| 05 07 10 | 1760.0       | 1560.        | 1560.        | S. L           | 9.00        | 370.                     | 358.                     | 48.                      | 0.                     |
| 05 07 17 | 1800.0       | 1520.        | 1520.        | S. L           | 8.95        | 362.                     | 368.                     | 40.                      | 0.                     |
| 05 07 24 | 1820.0       | 1560.        | 1560.        | S. L           | 8.95        | 366.                     | 368.                     | 33.                      | 0.                     |
| 05 07 31 | 1840.0       | 1540.        | 1530.        | 6.             | 8.95        | 362.                     | 368.                     | 33.                      | 0.                     |
| 05 08 08 | ---          | ---          | ---          | ---            | ---         | ---                      | ---                      | 43.                      | 0.                     |
| 05 08 15 | 1760.0       | 1590.        | 1500.        | S. L           | 8.75        | 358.                     | 354.                     | 41.                      | 0.                     |
| 05 08 21 | 1690.0       | 1510.        | 1510.        | S. L           | 8.90        | 348.                     | 351.                     | 36.                      | 0.                     |
| 05 08 27 | 1720.0       | 1440.        | 1440.        | S. L           | 8.90        | 352.                     | 327.                     | 50.                      | 0.                     |
| 05 10 24 | 1780.0       | 1460.        | 1460.        | S. L           | 8.95        | 356.                     | 337.                     | 49.                      | 0.                     |
| 06 01 14 | 1990.0       | 1680.        | 1680.        | S. L           | 8.75        | 396.                     | 415.                     | 34.                      | 0.                     |

| DATE     | CALCIUM<br>MG/CA/L | MAGNESIUM<br>MG/MG/L | HARDNESS<br>MG/CAC3/L | MANGANESE<br>MG/MN/L | IRON<br>MG/FE/L | POTASSIUM<br>MG/K/L | SODIUM<br>MG/NA/L | DO<br>MG/O2/L | TURBIDITY<br>NTU |
|----------|--------------------|----------------------|-----------------------|----------------------|-----------------|---------------------|-------------------|---------------|------------------|
| 05 07 03 | 35.                | 212.                 | 959.                  | 0.02                 | 0.05            | 45.                 | 51.               | 0.1           | 1.00             |
| 05 07 10 | 34.                | 209.                 | 944.                  | 0.04                 | 0.04            | 44.                 | 50.               | 9.2           | 1.00             |
| 05 07 17 | 34.                | 200.                 | 907.                  | 0.04                 | 0.04            | 45.                 | 51.               | 8.6           | 0.60             |
| 05 07 24 | 34.                | 210.                 | 949.                  | 0.04                 | 0.04            | 45.                 | 53.               | 8.0           | 1.03             |
| 05 08 01 | 31.                | 197.                 | 887.                  | 0.04                 | 0.04            | 45.                 | 53.               | 8.7           | 0.90             |
| 05 08 08 | 32.                | 221.                 | 1059.                 | 0.04                 | 0.04            | 47.                 | 52.               | 6.6           | 0.65             |
| 05 08 15 | 34.                | 221.                 | 1059.                 | 0.03                 | 0.14            | 53.                 | 50.               | 7.4           | 0.99             |
| 05 08 21 | 38.                | 231.                 | 873.                  | 0.03                 | 0.15            | 45.                 | 50.               | 9.0           | 1.03             |
| 05 08 27 | 39.                | 194.                 | 875.                  | 0.03                 | 0.14            | 45.                 | 53.               | 8.4           | 0.75             |
| 05 10 24 | 35.                | 238.                 | 1068.                 | 0.02                 | 0.16            | 46.                 | 57.               | 11.0          | 1.03             |
| 06 01 14 | 36.                | 216.                 | 978.                  | 0.06                 | 0.16            | 46.                 | 54.               | 10.0          | 0.60             |

| DATE     | SILICA<br>MG/SIO2/L | TRN<br>MG/NI/L | NI13 + NI14<br>MG/NI/L | NO3-NO2<br>MG/NI/L | P-TOTAL<br>MG/P/L | CHLORIDE<br>MG/CL/L | SULPHATE<br>MG/SO4/L | CHLORO-A<br>US/L | T-COLY<br>NTU/100 HL |
|----------|---------------------|----------------|------------------------|--------------------|-------------------|---------------------|----------------------|------------------|----------------------|
| 05 07 03 | 5.2                 | 1.60           | 0.01                   | 0.01 L             | 0.025             | 11.                 | 710.                 | 5.3              | 23                   |
| 05 07 10 | 5.1                 | 1.60           | 0.01                   | 0.01 L             | 0.020             | 13.                 | 725.                 | 7.6              | 4                    |
| 05 07 17 | 5.4                 | 1.70           | 0.02                   | 0.01 L             | 0.020             | 10.                 | 725.                 | 4.1              | 9                    |
| 05 07 24 | 6.2                 | 1.70           | 0.01                   | 0.01 L             | 0.025             | 11.                 | 755.                 | 3.5              | 7                    |
| 05 08 01 | 6.6                 | 1.70           | 0.01                   | 0.01 L             | 0.025             | 12.                 | 775.                 | 3.3              | 4                    |
| 05 08 08 | 6.6                 | 1.60           | 0.01                   | 0.01 L             | 0.025             | 11.                 | 765.                 | 3.5              | 23                   |
| 05 08 15 | 6.0                 | 1.60           | 0.02                   | 0.01 L             | 0.025             | 11.                 | 765.                 | 4.1              | 23                   |
| 05 08 21 | 6.0                 | 1.70           | 0.03                   | 0.01 L             | 0.025             | 11.                 | 760.                 | 3.5              | 23                   |
| 05 08 27 | 7.0                 | 1.70           | 0.01                   | 0.01 L             | 0.020             | 12.                 | 760.                 | 3.5              | 0                    |
| 05 10 24 | 6.3                 | 1.70           | 0.00                   | 0.01 L             | 0.020             | 12.                 | 715.                 | ---              | ---                  |
| 06 01 14 | 6.4                 | 2.00           | 0.05                   | 0.01               | 0.020             | 13.                 | 625.                 | ---              | ---                  |

| DATE     | F-COLY<br>MMU/100 HL | SECCI DISC<br>METRES |
|----------|----------------------|----------------------|
| 05 07 03 | 0                    | 3.50                 |
| 05 07 10 | 0                    | 3.00                 |
| 05 07 17 | 0                    | 3.50                 |
| 05 07 24 | 4                    | 2.30                 |
| 05 07 31 | 0                    | 2.60                 |
| 05 08 08 | 9                    | 2.00                 |
| 05 08 15 | 15                   | 2.00                 |
| 05 08 21 | 23                   | 2.10                 |
| 05 08 27 | 0                    | 2.50                 |
| 05 10 24 | ---                  | ---                  |
| 06 01 14 | ---                  | ---                  |

Appendix IV(h-i)

STATION W2093, SOURCE - HOROD (CZORNI) LAKE  
SAMPLING LOCATION - N END LATITUDE 50:40 LONGITUDE 100:21

FROM 05 06 01  
TO 06 01 31

| DATE     | COD<br>US/CM | T.B.<br>MG/L | F.B.<br>MG/L | H.F.R.<br>MG/L | PH<br>UNITS | ALKALINITY<br>MG/CAC03/L | ALKALINITY<br>MG/CO3/L | ALKALINITY<br>MG/CO3/L | ALKALINITY<br>MG/CO3/L |
|----------|--------------|--------------|--------------|----------------|-------------|--------------------------|------------------------|------------------------|------------------------|
| 05 07 04 | 470.0        | 352.         | 350.         | S. L           | 6.55        | 228.                     | 254.                   | 12.                    | 0.                     |
| 05 07 11 | 446.0        | 310.         | 310.         | S. L           | 6.55        | 226.                     | 261.                   | 7.                     | 0.                     |
| 05 07 16 | 466.0        | 325.         | 310.         | S. L           | 6.45        | 226.                     | 259.                   | 7.                     | 0.                     |
| 05 07 25 | 472.0        | 313.         | 310.         | S. L           | 6.50        | 226.                     | 261.                   | 7.                     | 0.                     |
| 05 08 01 | 461.0        | 310.         | 310.         | S. L           | 6.60        | 222.                     | 246.                   | 12.                    | 0.                     |
| 05 08 09 | 461.0        | 300.         | 300.         | S. L           | 6.45        | 224.                     | 259.                   | 7.                     | 0.                     |
| 05 08 15 | 450.0        | 310.         | 310.         | S. L           | 6.45        | 216.                     | 251.                   | 5.                     | 0.                     |
| 05 08 22 | 405.0        | 313.         | 310.         | S. L           | 6.50        | 216.                     | 249.                   | 7.                     | 0.                     |
| 05 08 27 | 446.0        | 283.         | 288.         | S. L           | 6.55        | 216.                     | 244.                   | 10.                    | 0.                     |
| 05 10 23 | 454.0        | 420.         | 420.         | S. L           | 6.55        | 220.                     | 254.                   | 7.                     | 0.                     |
| 06 01 14 | 525.0        | 340.         | 340.         | S. L           | 6.30        | 262.                     | 320.                   | 0.                     | 0.                     |

| DATE     | CALCIUM<br>MG/CA/L | MAGNESIUM<br>MG/MG/L | HARDNESS<br>MG/CAC03/L | MANGANESE<br>MG/MN/L | IRON<br>MG/FE/L | POTASSIUM<br>MG/K/L | SODIUM<br>MG/NA/L | DO<br>MG/O2/L | TURBIDITY<br>NTU |
|----------|--------------------|----------------------|------------------------|----------------------|-----------------|---------------------|-------------------|---------------|------------------|
| 05 07 04 | 30.                | 54.                  | 2%                     | 0.00                 | 0.17            | 9.                  | 5.                | 9.4           | 0.05             |
| 05 07 11 | 25.                | 50.                  | 270.                   | 0.05                 | 0.02 L          | 0.                  | 5. L              | 6.5           | 0.50             |
| 05 07 16 | 26.                | 51.                  | 274.                   | 0.09                 | 0.02            | 9.                  | 5.                | 7.2           | 0.05             |
| 05 07 25 | 27.                | 54.                  | 270.                   | 0.00                 | 0.02 L          | 0.                  | 5. L              | 7.4           | 0.00             |
| 05 08 01 | 25.                | 52.                  | 275.                   | 0.07                 | 0.02 L          | 0.                  | 5. L              | 9.3           | 0.70             |
| 05 08 09 | 25.                | 53.                  | 277.                   | 0.08                 | 0.03 L          | 9.                  | 5.                | 7.4           | 0.05             |
| 05 08 15 | 24.                | 55.                  | 289.                   | 0.05                 | 0.03 L          | 0.                  | 5.                | 7.9           | 0.05             |
| 05 08 22 | 25.                | 54.                  | 285.                   | 0.04                 | 0.02 L          | 0.                  | 5.                | 6.6           | 0.05             |
| 05 08 27 | 27.                | 56.                  | 296.                   | 0.06                 | 0.04 L          | 0.                  | 4.                | ---           | 0.65             |
| 05 10 23 | 20.                | 39.                  | 210.                   | 0.02 L               | 0.02 L          | 9.                  | 4.                | 11.7          | 0.70             |
| 06 01 14 | 31.                | 52.                  | 290.                   | 0.05                 | 0.04            | 9.                  | 5.                | 9.6           | 0.93             |

| DATE     | SILICA<br>MG/SIO2/L | THM<br>MG/TH/L | NO3 + NO2<br>MG/N/L | NO3-NO2<br>MG/NO3/L | P-TOTAL<br>MG/P/L | CHLORIDE<br>MG/CL/L | SULFATE<br>MG/SO4/L | CHLORO-A<br>US/L | T. COLI<br>MPN/100 ML |
|----------|---------------------|----------------|---------------------|---------------------|-------------------|---------------------|---------------------|------------------|-----------------------|
| 05 07 04 | 7.9                 | 1.10           | 0.00                | 0.01 L              | 0.020             | 3.                  | 35.                 | 3.5              | 0                     |
| 05 07 11 | 7.6                 | 1.10           | 0.04                | 0.01 L              | 0.010             | 3.                  | 33.                 | 7.0              | 0                     |
| 05 07 16 | 9.0                 | 1.10           | 0.03                | 0.01 L              | 0.01              | 3.                  | 40.                 | 14.0             | 7                     |
| 05 07 25 | 9.0                 | 1.10           | 0.02                | 0.01 L              | 0.013             | 3.                  | 35.                 | 14.0             | 7                     |
| 05 08 01 | 9.7                 | 1.10           | 0.01                | 0.01 L              | 0.010             | 3.                  | 35.                 | 251.0            | 0                     |
| 05 08 09 | 10.0                | 1.20           | 0.02                | 0.01 L              | 0.010             | 3.                  | 33.                 | 197.3            | 9                     |
| 05 08 15 | 11.0                | 1.30           | 0.02                | 0.01 L              | 0.015             | 3.                  | 33.                 | 3.5              | 23                    |
| 05 08 22 | 10.0                | 1.10           | 0.02                | 0.01 L              | 0.015             | 3.                  | 40.                 | 3.9              | 15                    |
| 05 08 27 | 11.0                | 1.00           | 0.01                | 0.01 L              | 0.015             | 3.                  | 39.                 | 2.6              | 9                     |
| 05 10 23 | 11.0                | 1.10           | 0.02                | 0.01 L              | 0.010             | 4.                  | 30.                 | ---              | ---                   |
| 06 01 14 | 12.0                | 1.20           | 0.06                | 0.02                | 0.010             | 4.                  | 30.                 | ---              | ---                   |

| DATE     | F. COLI<br>MPN/100 ML | SECCCHI DISC<br>METRES |
|----------|-----------------------|------------------------|
| 05 07 04 | 0                     | 3.20                   |
| 05 07 11 | 0                     | 3.00                   |
| 05 07 16 | 0                     | 3.10                   |
| 05 07 25 | 0                     | 3.00                   |
| 05 08 01 | 0                     | 2.70                   |
| 05 08 09 | 0                     | 3.00                   |
| 05 08 15 | 0                     | 2.80                   |
| 05 08 22 | 0                     | 3.00                   |
| 05 08 27 | 0                     | 4.50                   |
| 05 10 23 | ---                   | ---                    |
| 06 01 14 | ---                   | ---                    |

Appendix IV(h-ii)

STATION W0064, SOURCE - HOROB (CZORNI) LAKE  
SAMPLING LOCATION - MIDDLE LATITUDE 50:41 LONGITUDE 100:21

FROM 85 06 01  
TO 86 01 31

| DATE     | COD<br>US/CH | T.R.<br>MG/L | F.R.<br>MG/L | N.F.R.<br>MG/L | PH<br>UNITS | ALKALINITY<br>MG(CACO3)/L | ALKALINITY<br>MG(CO3)/L | ALKALINITY<br>MG(OH)/L |
|----------|--------------|--------------|--------------|----------------|-------------|---------------------------|-------------------------|------------------------|
| 85 07 04 | 470.0        | 340.         | 340.         | 5.1            | 6.45        | 222.                      | 10.                     | 0.                     |
| 85 07 11 | 446.0        | 320.         | 320.         | 5.1            | 6.75        | 224.                      | 14.                     | 0.                     |
| 85 07 18 | 475.0        | 310.         | 310.         | 5.1            | 6.75        | 220.                      | 19.                     | 0.                     |
| 85 07 25 | 472.0        | 310.         | 310.         | 5.1            | 6.40        | 220.                      | 12.                     | 0.                     |
| 85 08 01 | 466.0        | 320.         | 320.         | 5.1            | 6.45        | 222.                      | 5.                      | 0.                     |
| 85 08 09 | 457.0        | 280.         | 280.         | 5.1            | 6.55        | 210.                      | 7.                      | 0.                     |
| 85 08 15 | 451.0        | 310.         | 310.         | 5.1            | 6.45        | 216.                      | 5.                      | 0.                     |
| 85 08 22 | 444.0        | 300.         | 300.         | 5.1            | 6.55        | 212.                      | 10.                     | 0.                     |
| 85 08 27 | 445.0        | 280.         | 280.         | 5.1            | 6.40        | 216.                      | 10.                     | 0.                     |
| 85 10 23 | 454.0        | 400.         | 400.         | 5.1            | 6.80        | 218.                      | 7.                      | 0.                     |
| 86 01 14 | 525.0        | 330.         | 330.         | 5.1            | 6.25        | 256.                      | 0.                      | 0.                     |

| DATE     | CALCIUM<br>MG(CA)/L | MAGNESIUM<br>MG(MG)/L | HARDNESS<br>MG(CACO3)/L | MANGANESE<br>MG(MN)/L | IRON<br>MG(Fe)/L | POTASSIUM<br>MG(K)/L | SODIUM<br>MG(Na)/L | DO<br>MG(O2)/L | TEMPERATURE<br>NTU |
|----------|---------------------|-----------------------|-------------------------|-----------------------|------------------|----------------------|--------------------|----------------|--------------------|
| 85 07 04 | 26.                 | 53.                   | 269.                    | 0.05                  | 0.03             | 0.                   | 5.1                | 9.3            | 0.55               |
| 85 07 11 | 25.                 | 50.                   | 270.                    | 0.06                  | 0.02             | 0.                   | 5.1                | 0.5            | 0.65               |
| 85 07 18 | 26.                 | 53.                   | 263.                    | 0.07                  | 0.02             | 0.                   | 5.1                | 7.7            | 0.73               |
| 85 07 25 | 27.                 | 55.                   | 291.                    | 0.08                  | 0.02             | 0.                   | 5.1                | 7.3            | 1.00               |
| 85 08 01 | 24.                 | 51.                   | 271.                    | 0.07                  | 0.02             | 0.                   | 5.1                | 6.             | 0.70               |
| 85 08 09 | 25.                 | 54.                   | 284.                    | 0.08                  | 0.02             | 0.                   | 5.1                | 7.             | 0.52               |
| 85 08 15 | 26.                 | 55.                   | 289.                    | 0.05                  | 0.02             | 0.                   | 5.1                | 6.0            | 0.65               |
| 85 08 22 | 26.                 | 55.                   | 286.                    | 0.07                  | 0.02             | 0.                   | 5.1                | 6.8            | 0.60               |
| 85 08 27 | 26.                 | 54.                   | 294.                    | 0.07                  | 0.02             | 0.                   | 7.                 | 11.7           | 0.50               |
| 85 10 23 | 46.                 | 54.                   | 325.                    | 0.02                  | 0.02             | 11.                  | 7.                 | 9.4            | 0.55               |
| 86 01 14 | 30.                 | 50.                   | 293.                    | 0.09                  | 0.04             | 9.                   | 5.                 |                |                    |

| DATE     | SILICA<br>MG(SIO2)/L | TPH<br>MG(H)/L | NO3 + NH4<br>MG(N)/L | NO3-NO2<br>MG(N)/L | P-TOTAL<br>MG(P)/L | CHLORIDE<br>MG(CL)/L | SULPHATE<br>MG(SO4)/L | CHLORO-A<br>MG/L | T-COLI<br>MPN/100 ML |
|----------|----------------------|----------------|----------------------|--------------------|--------------------|----------------------|-----------------------|------------------|----------------------|
| 85 07 04 | 7.9                  | 1.10           | 0.01                 | 0.02               | 0.020              | 3.                   | 35.                   | 1.0              | 4                    |
| 85 07 11 | 7.8                  | 1.08           | 0.01                 | 0.01               | 0.015              | 3.                   | 35.                   | 370.7            | 9                    |
| 85 07 18 | 8.                   | 1.10           | 0.01                 | 0.01               | 0.015              | 3.                   | 35.                   | 94.2             | 9                    |
| 85 07 25 | 9.2                  | 1.10           | 0.01                 | 0.01               | 0.015              | 3.                   | 35.                   | 83.9             | 0                    |
| 85 08 01 | 9.9                  | 1.10           | 0.01                 | 0.01               | 0.015              | 3.                   | 33.                   | 35.0             | 4                    |
| 85 08 09 | 10.0                 | 1.20           | 0.02                 | 0.01               | 0.015              | 31.                  | 30.                   | 43.7             | 0                    |
| 85 08 15 | 11.0                 | 1.00           | 0.03                 | 0.01               | 0.015              | 3.                   | 35.                   | 1.2              | 9                    |
| 85 08 22 | 11.0                 | 1.10           | 0.02                 | 0.01               | 0.025              | 3.                   | 30.                   | 3.1              | 0                    |
| 85 08 27 | 11.0                 | 1.00           | 0.01                 | 0.01               | 0.015              | 3.                   | 33.                   | 2.2              | 4                    |
| 85 10 23 | 11.0                 | 1.00           | 0.02                 | 0.01               | 0.010              | 3.                   | 30.                   | ---              | ---                  |
| 86 01 14 | 12.0                 | 1.20           | 0.11                 | 0.03               | 0.010              | 3.                   | 33.                   | ---              | ---                  |

| DATE     | F. COLI<br>MPN/100 ML | SECCHI DISC<br>METRES |
|----------|-----------------------|-----------------------|
| 85 07 04 | 0                     | 4.00                  |
| 85 07 11 | 0                     | 3.10                  |
| 85 07 18 | 0                     | 3.60                  |
| 85 07 25 | 0                     | 2.90                  |
| 85 08 01 | 0                     | 2.20                  |
| 85 08 09 | 0                     | 2.60                  |
| 85 08 15 | 4                     | 3.60                  |
| 85 08 22 | 0                     | 3.50                  |
| 85 08 27 | 0                     | 3.50                  |
| 85 10 23 | ---                   | 5.00                  |
| 86 01 14 | ---                   | ---                   |

Appendix IV(h-iii)

STATION 100095, SOURCE - NORDO (CORN) LAKE  
SAMPLING LOCATION - S E END LATITUDE 30°41' LONGITUDE 100°21'

FROM 05 06 01  
TO 06 01 31

| DATE     | COD<br>US/CH | T.B.<br>MG/L | F.B.<br>MG/L | M.F.B.<br>MG/L | PH<br>UNITS | ALKALINITY<br>MG(CACO3)/L | ALKALINITY<br>MG(MCO3)/L | ALKALINITY<br>MG(CO3)/L | ALKALINITY<br>MG(OH)/L |
|----------|--------------|--------------|--------------|----------------|-------------|---------------------------|--------------------------|-------------------------|------------------------|
| 05 07 04 | 444.0        | 340.         | 340.         | 5. L           | 0.55        | 228.                      | 261.                     | 7.                      | 0.                     |
| 05 07 11 | 447.0        | 320.         | 320.         | 5. L           | 0.65        | 228.                      | 254.                     | 10.                     | 0.                     |
| 05 07 18 | 427.0        | 310.         | 310.         | 5. L           | 0.95        | 228.                      | 222.                     | 26.                     | 0.                     |
| 05 07 25 | 472.0        | 310.         | 310.         | 5. L           | 0.55        | 228.                      | 259.                     | 10.                     | 0.                     |
| 05 08 01 | 481.0        | 330.         | 330.         | 5. L           | 0.40        | 210.                      | 246.                     | 10.                     | 0.                     |
| 05 08 09 | 454.0        | 310.         | 310.         | 5. L           | 0.50        | 222.                      | 256.                     | 7.                      | 0.                     |
| 05 08 15 | 451.0        | 310.         | 310.         | 5. L           | 0.55        | 215.                      | 254.                     | 5.                      | 0.                     |
| 05 08 22 | 444.0        | 300.         | 300.         | 5. L           | 0.45        | 214.                      | 244.                     | 10.                     | 0.                     |
| 05 08 27 | 448.0        | 280.         | 280.         | 5. L           | 0.50        | 214.                      | 244.                     | 10.                     | 0.                     |
| 05 10 23 | 445.0        | 410.         | 410.         | 5. L           | 0.50        | 210.                      | 258.                     | 5.                      | 0.                     |
| 06 01 14 | 540.0        | 340.         | 340.         | 5. L           | 0.65        | 272.                      | 312.                     | 0.                      | 0.                     |

| DATE     | CALCIUM<br>MG(CA)/L | HARDNESS<br>MG(CACO3)/L | MANGANESE<br>MG(MN)/L | IRON<br>MG(Fe)/L | POTASSIUM<br>MG(K)/L | SODIUM<br>MG(Na)/L | DO<br>MG(O2)/L | TURBIDITY<br>NTU |
|----------|---------------------|-------------------------|-----------------------|------------------|----------------------|--------------------|----------------|------------------|
| 05 07 04 | 29.                 | 54.                     | 0.05                  | 0.02             | 9.                   | 5. L               | 8.0            | 0.90             |
| 05 07 11 | 25.                 | 50.                     | 0.05                  | 0.02             | 8.                   | 5. L               | 8.0            | 0.45             |
| 05 07 18 | 26.                 | 53.                     | 0.07                  | 0.02             | 8.                   | 5. L               | 7.7            | 0.45             |
| 05 07 25 | 27.                 | 55.                     | 0.07                  | 0.02 L           | 8.                   | 5. L               | 7.6            | 0.50             |
| 05 08 01 | 24.                 | 51.                     | 0.05                  | 0.02             | 8.                   | 5. L               | 9.2            | 0.40             |
| 05 08 09 | 25.                 | 54.                     | 0.05                  | 0.02             | 8.                   | 5. L               | 7.6            | 0.40             |
| 05 08 15 | 26.                 | 55.                     | 0.05                  | 0.03             | 8.                   | 5. L               | 8.2            | 0.45             |
| 05 08 22 | 25.                 | 54.                     | 0.04                  | 0.02 L           | 8.                   | 5. L               | 8.5            | 0.55             |
| 05 08 27 | 25.                 | 54.                     | 0.05                  | 0.02             | 8.                   | 5. L               | 8.5            | 0.55             |
| 05 10 23 | 27.                 | 53.                     | 0.06                  | 0.03             | 9.                   | 5. L               | 11.2           | 0.55             |
| 06 01 14 | 35.                 | 51.                     | 0.05                  | 0.05             | 9.                   | 5. L               | 4.5            | 1.50             |

| DATE     | SILICA<br>MG(SIO2)/L | TPH<br>MG(H)/L | PHOS + MON<br>MG(P)/L | NO3-NO2<br>MG(N)/L | P-TOTAL<br>MG(P)/L | CHLORIDE<br>MG(CL)/L | SULPHATE<br>MG(SO4)/L | CHLORO-A<br>UG/L | T-COLI<br>MTU/100 ML |
|----------|----------------------|----------------|-----------------------|--------------------|--------------------|----------------------|-----------------------|------------------|----------------------|
| 05 07 04 | 8.0                  | 1.10           | 0.01                  | 0.02               | 0.020              | 3.                   | 30.                   | 2.4              | 23                   |
| 05 07 11 | 7.9                  | 2.08           | 0.04                  | 0.01 L             | 0.015              | 3.                   | 33.                   | 56.0             | 0                    |
| 05 07 18 | 9.9                  | 1.10           | 0.01                  | 0.01 L             | 0.015              | 3.                   | 33.                   | 42.0             | 0                    |
| 05 07 25 | 9.2                  | 1.10           | 0.01                  | 0.01 L             | 0.015              | 3.                   | 33.                   | 97.0             | 15                   |
| 05 08 01 | 9.9                  | 1.10           | 0.01                  | 0.01 L             | 0.015              | 3.                   | 33.                   | 15.3             | 42                   |
| 05 08 09 | 10.0                 | 0.95           | 0.03                  | 0.01 L             | 0.015              | 3.                   | 35.                   | 7.4              | 14                   |
| 05 08 15 | 11.0                 | 1.10           | 0.02                  | 0.01 L             | 0.020              | 3.                   | 40.                   | 2.6              | 4                    |
| 05 08 22 | 11.0                 | 1.00           | 0.01                  | 0.01 L             | 0.015              | 3.                   | 33.                   | 6.0              | 0                    |
| 05 08 27 | 11.0                 | 1.00           | 0.01                  | 0.01 L             | 0.015              | 3.                   | 35.                   | ---              | ---                  |
| 05 10 23 | 11.0                 | 1.00           | 0.02                  | 0.01 L             | 0.015              | 3.                   | 35.                   | ---              | ---                  |
| 06 01 14 | 14.0                 | 1.40           | 0.10                  | 0.01 L             | 0.010              | 3.                   | 20.                   | ---              | ---                  |

| DATE     | F-COLI<br>MTU/100 ML | SECCHI DISC<br>HEPES |
|----------|----------------------|----------------------|
| 05 07 04 | 0                    | 3.50                 |
| 05 07 11 | 0                    | 3.10                 |
| 05 07 18 | 0                    | 3.20                 |
| 05 07 25 | 0                    | 2.00                 |
| 05 08 01 | 0                    | 2.00                 |
| 05 08 09 | 4                    | 2.90                 |
| 05 08 15 | 4                    | 3.00                 |
| 05 08 22 | 0                    | 3.50                 |
| 05 08 27 | 0                    | 3.00                 |
| 05 10 23 | ---                  | ---                  |
| 06 01 14 | ---                  | ---                  |

Appendix IV(i-i)

STATION H20957, SOURCE - BLUE (DUFFY) LAKE  
SAMPLING LOCATION - S END LATITUDE 38°36' LONGITUDE 100°21'

FROM 05 06 01  
TO 06 01 31

| DATE     | COD<br>US/CM | T.P.<br>MG/L | F.P.<br>MG/L | M.F.P.<br>MG/L | PH<br>UNITS | ALPHEINITY<br>MG/CAC03/L | ALPHEINITY<br>MG/C03/L | ALPHEINITY<br>MG/C03/L |
|----------|--------------|--------------|--------------|----------------|-------------|--------------------------|------------------------|------------------------|
| 05 07 04 | 1590.0       | 1350.        | 1350.        | S. L           | 8.05        | 484.                     | 488.                   | 50.                    |
| 05 07 11 | 1610.0       | 1280.        | 1280.        | S. L           | 8.90        | 480.                     | 498.                   | 48.                    |
| 05 07 18 | 1610.0       | 1250.        | 1250.        | S. L           | 8.75        | 490.                     | 498.                   | 50.                    |
| 05 07 25 | 1620.0       | 1310.        | 1310.        | S. L           | 8.65        | 500.                     | 428.                   | 60.                    |
| 05 08 01 | 1650.0       | 1350.        | 1350.        | S. L           | 8.95        | 476.                     | 473.                   | 65.                    |
| 05 08 09 | 1560.0       | 1290.        | 1290.        | S. L           | 8.95        | 474.                     | 481.                   | 60.                    |
| 05 08 16 | 1560.0       | 1270.        | 1270.        | S. L           | 8.85        | 466.                     | 471.                   | 60.                    |
| 05 08 22 | 1560.0       | 1250.        | 1250.        | S. L           | 8.90        | 466.                     | 492.                   | 43.                    |
| 05 08 27 | 1550.0       | 1240.        | 1240.        | S. L           | 8.90        | 466.                     | 466.                   | 62.                    |
| 05 08 31 | 1590.0       | 1370.        | 1370.        | S. L           | 8.08        | 480.                     | 478.                   | 55.                    |
| 06 01 14 | 1690.0       | 1380.        | 1380.        | S. L           | 8.00        | 532.                     | 561.                   | 43.                    |

| DATE     | CALCIUM<br>MG/CA/L | MAGNESIUM<br>MG/MG/L | HARDNESS<br>MG/CAC03/L | MANGANESE<br>MG/MN/L | IRON<br>MG/FE/L | POTASSIUM<br>MG/K/L | SODIUM<br>MG/NA/L | DO<br>MG/O2/L | TURBIDITY<br>NTU |
|----------|--------------------|----------------------|------------------------|----------------------|-----------------|---------------------|-------------------|---------------|------------------|
| 05 07 04 | 22.                | 205.                 | 899.                   | 0.04                 | 0.06            | 33.                 | 50.               | 10.3          | 1.00             |
| 05 07 11 | 21.                | 209.                 | 871.                   | 0.04                 | 0.06            | 32.                 | 50.               | 11.4          | 1.00             |
| 05 07 18 | 22.                | 207.                 | 907.                   | 0.04                 | 0.04            | 34.                 | 50.               | 8.2           | 1.00             |
| 05 07 25 | 21.                | 195.                 | 859.                   | 0.05                 | 0.04            | 33.                 | 47.               | 8.5           | 1.00             |
| 05 08 01 | 21.                | 212.                 | 926.                   | 0.04                 | 0.04            | 35.                 | 49.               | 8.2           | 0.65             |
| 05 08 09 | 21.                | 206.                 | 900.                   | 0.04                 | 0.04            | 34.                 | 48.               | 7.6           | 0.65             |
| 05 08 16 | 21.                | 211.                 | 922.                   | 0.06                 | 0.04            | 34.                 | 48.               | 7.4           | 0.90             |
| 05 08 22 | 22.                | 199.                 | 833.                   | 0.04                 | 0.03            | 33.                 | 50.               | 7.0           | 1.00             |
| 05 08 27 | 21.                | 226.                 | 906.                   | 0.03                 | 0.04            | 36.                 | 47.               | 10.9          | 1.00             |
| 05 10 23 | 22.                | 202.                 | 869.                   | 0.04                 | 0.06            | 36.                 | 48.               | 7.5           | 0.70             |
| 06 01 14 | 23.                | 202.                 | 869.                   | 0.04                 | 0.06            | 36.                 | 48.               | 7.5           | 0.70             |

| DATE     | SILICA<br>MG/SIO2/L | TSN<br>MG/N/L | PHOS + NH4<br>MG/P/L | MD3-MD2<br>MG/H/L | P-TOTAL<br>MG/P/L | CHLORIDE<br>MG/CL/L | SULPHATE<br>MG/SO4/L | CHLORO-A<br>MG/L | T-COL2<br>MG/L |
|----------|---------------------|---------------|----------------------|-------------------|-------------------|---------------------|----------------------|------------------|----------------|
| 05 07 04 | 0.3                 | 2.23          | 0.02                 | 0.01 L            | 0.045             | 8.                  | 450.                 | 10.5             | 0              |
| 05 07 11 | 0.4                 | 2.00          | 0.01                 | 0.01 L            | 0.025             | 8.                  | 490.                 | 3.5              | 4              |
| 05 07 18 | 0.2 L               | 2.10          | 0.07                 | 0.01 L            | 0.040             | 8.                  | 495.                 | 6.1              | 0              |
| 05 07 25 | 0.9                 | 2.30          | 0.01                 | 0.01 L            | 0.025             | 9.                  | 510.                 | 5.3              | 4              |
| 05 08 01 | 1.2                 | 2.20          | 0.01                 | 0.01 L            | 0.025             | 9.                  | 506.                 | 4.7              | 3              |
| 05 08 09 | 1.5                 | 2.30          | 0.02                 | 0.01 L            | 0.025             | 9.                  | 515.                 | 6.1              | 0              |
| 05 08 16 | 1.8                 | 2.20          | 0.02                 | 0.01 L            | 0.030             | 8.                  | 496.                 | 4.8              | 11             |
| 05 08 22 | 2.2                 | 2.40          | 0.03                 | 0.01 L            | 0.020             | 8.                  | 510.                 | 7.9              | 4              |
| 05 08 27 | 2.4                 | 2.30          | 0.01                 | 0.01 L            | 0.020             | 8.                  | 510.                 | 7.9              | 4              |
| 05 08 31 | 2.2                 | 2.30          | 0.01                 | 0.02              | 0.035             | 9.                  | 450.                 | ---              | ---            |
| 06 01 14 | 2.2                 | 2.50          | 0.16                 | 0.03              | 0.020             | 0.                  | 550.                 | ---              | ---            |

| DATE     | F-COL1<br>MPN/100 ML | SECCHI DISC<br>METRES |
|----------|----------------------|-----------------------|
| 05 07 04 | 0                    | 2.58                  |
| 05 07 11 | 0                    | 2.18                  |
| 05 07 18 | 0                    | 2.64                  |
| 05 07 25 | 0                    | 2.48                  |
| 05 08 01 | 0                    | 2.02                  |
| 05 08 09 | 4                    | 1.80                  |
| 05 08 16 | 0                    | 1.50                  |
| 05 08 22 | 0                    | 1.60                  |
| 05 08 27 | ---                  | 2.00                  |
| 05 10 23 | ---                  | ---                   |
| 06 01 14 | ---                  | ---                   |

# Appendix IV(i-11)

STATION W04958, SOURCE - BLUE (DU MY) LAKE  
SAMPLING LOCATION - E END LATITUDE 59:36 LONGITUDE 100:21

FROM 05 06 01  
TO 06 01 31

| DATE     | COND<br>US/CM | T.R.<br>MG/L | F.R.<br>MG/L | H.F.R.<br>MG/L | PH<br>UNITS | ALKALINITY<br>MG(CACO3)/L | ALKALINITY<br>MG(CO3)/L | ALKALINITY<br>MG(OH)/L |
|----------|---------------|--------------|--------------|----------------|-------------|---------------------------|-------------------------|------------------------|
| 05 07 04 | 1590.0        | 1370.        | 1370.        | 5. L           | 8.05        | 490.                      | 493.                    | 55.                    |
| 05 07 11 | 1610.0        | 1290.        | 1290.        | 5. L           | 8.05        | 492.                      | 493.                    | 55.                    |
| 05 07 18 | 1620.0        | 1310.        | 1310.        | 5. L           | 8.95        | 492.                      | 493.                    | 70.                    |
| 05 07 25 | 1630.0        | 1310.        | 1310.        | 5. L           | 8.00        | 492.                      | 493.                    | 70.                    |
| 05 08 01 | 1640.0        | 1350.        | 1360.        | 5. L           | 8.90        | 498.                      | 495.                    | 65.                    |
| 05 08 09 | 1550.0        | 1310.        | 1310.        | 5. L           | 8.90        | 498.                      | 493.                    | 53.                    |
| 05 08 16 | 1560.0        | 1280.        | 1280.        | 5. L           | 8.90        | 465.                      | 468.                    | 50.                    |
| 05 08 22 | 1550.0        | 1250.        | 1250.        | 5. L           | 8.90        | 468.                      | 463.                    | 55.                    |
| 05 08 29 | 1550.0        | 1250.        | 1250.        | 5. L           | 9.00        | 468.                      | 491.                    | 55.                    |
| 05 10 01 | 1570.0        | 1370.        | 1370.        | 5. L           | 8.95        | 490.                      | 490.                    | 53.                    |
| 06 01 14 | 1690.0        | 1350.        | 1350.        | 5. L           | 8.00        | 536.                      | 551.                    | 55.                    |

| DATE     | CALCIUM<br>MG/L | IRON<br>MG/L | POTASSIUM<br>MG/L | SODIUM<br>MG/L | DO<br>MG/L | TURBIDITY<br>NTU |
|----------|-----------------|--------------|-------------------|----------------|------------|------------------|
| 05 07 04 | 23.             | 0.04         | 34.               | 54.            | 10.5       | 1.50             |
| 05 07 11 | 21.             | 0.05         | 33.               | 45.            | 10.0       | 1.00             |
| 05 07 18 | 20.             | 0.03         | 33.               | 47.            | 9.9        | 0.50             |
| 05 07 25 | 21.             | 0.06         | 33.               | 50.            | 7.7        | 1.00             |
| 05 08 01 | 21.             | 0.05         | 36.               | 48.            | 8.1        | 0.70             |
| 05 08 09 | 20.             | 0.04         | 35.               | 49.            | 7.7        | 1.00             |
| 05 08 16 | 21.             | 0.03         | 38.               | 49.            | 8.7        | 1.00             |
| 05 08 22 | 22.             | 0.06         | 33.               | 50.            | 7.0        | 0.65             |
| 05 08 29 | 21.             | 0.05         | 37.               | 49.            | 11.5       | 1.00             |
| 05 10 01 | 23.             | 0.03         | 36.               | 49.            | 8.5        | 1.00             |
| 06 01 14 | 25.             | 0.06         | 36.               | 49.            |            |                  |

| DATE     | SILICA<br>MG/SIO2/L | CHLORIDE<br>MG/L | SULPHATE<br>MG/SO4/L | CHLORO-A<br>UF/L | T. COLI<br>MPN/100 ML |
|----------|---------------------|------------------|----------------------|------------------|-----------------------|
| 05 07 04 | 0.2                 | 7.               | 515.                 | 7.9              | 4                     |
| 05 07 11 | 0.4                 | 8.               | 506.                 | 3.5              | 0                     |
| 05 07 18 | 0.6                 | 9.               | 510.                 | 6.1              | 7                     |
| 05 07 25 | 0.8                 | 9.               | 510.                 | 3.1              | 0                     |
| 05 08 01 | 1.2                 | 9.               | 515.                 | 0.7              | 0                     |
| 05 08 09 | 1.4                 | 8.               | 506.                 | 5.3              | 0                     |
| 05 08 16 | 1.6                 | 9.               | 495.                 | 12.1             | 4                     |
| 05 08 22 | 1.0                 | 9.               | 495.                 | 0.1              | 0                     |
| 05 08 29 | 1.2                 | 9.               | 506.                 | ---              | ---                   |
| 05 10 01 | 2.2                 | 8.               | 506.                 | ---              | ---                   |
| 06 01 14 | 2.2                 | 8.               | 509.                 | ---              | ---                   |

| DATE     | F. COLI<br>MPN/100 ML | SECCHI DISC<br>MMES |
|----------|-----------------------|---------------------|
| 05 07 04 | 0                     | 2.20                |
| 05 07 11 | 0                     | 2.10                |
| 05 07 18 | 0                     | 2.10                |
| 05 07 25 | 0                     | 2.20                |
| 05 08 01 | 0                     | 2.00                |
| 05 08 09 | 6                     | 1.70                |
| 05 08 16 | 0                     | 1.60                |
| 05 08 22 | 0                     | 1.30                |
| 05 08 29 | ---                   | 1.00                |
| 05 10 01 | ---                   | ---                 |
| 06 01 14 | ---                   | ---                 |

Appendix IV(1-iii)

STATION 100559, SOURCE - BLUE (DURRY) LAKE  
SAMPLING LOCATION - W END LATITUDE 50°34' LONGITUDE 100°23'

FROM 05 01 01  
TO 06 01 31

| DATE     | COD<br>US/CH | T.R.<br>MG/L | F.R.<br>MG/L | H.F.R.<br>MG/L | PH<br>UNITS | ALKALINITY<br>MG(CO3)/L | ALKALINITY<br>MG(CO3)/L | ALKALINITY<br>MG(CO3)/L |
|----------|--------------|--------------|--------------|----------------|-------------|-------------------------|-------------------------|-------------------------|
| 05 07 04 | 1570.0       | 1370.        | 1370.        | 5. L           | 0.55        | 490.                    | 50.                     | 0.                      |
| 05 07 11 | 1620.0       | 1300.        | 1300.        | 5. L           | 0.55        | 490.                    | 53.                     | 0.                      |
| 05 07 18 | ---          | ---          | ---          | ---            | ---         | ---                     | ---                     | ---                     |
| 05 07 25 | 1620.0       | 1330.        | 1330.        | 5. L           | 0.55        | 490.                    | 470.                    | 0.                      |
| 05 08 01 | 1640.0       | 1370.        | 1370.        | 5. L           | 0.50        | 490.                    | 470.                    | 0.                      |
| 05 08 09 | 1500.0       | 1310.        | 1310.        | 5. L           | 0.50        | 490.                    | 470.                    | 0.                      |
| 05 08 16 | 1500.0       | 1300.        | 1300.        | 5. L           | 0.50        | 490.                    | 470.                    | 0.                      |
| 05 08 22 | 1500.0       | 1290.        | 1290.        | 5. L           | 0.50        | 490.                    | 470.                    | 0.                      |
| 05 08 27 | 1500.0       | 1290.        | 1290.        | 5. L           | 0.50        | 490.                    | 470.                    | 0.                      |
| 05 08 31 | 1500.0       | 1290.        | 1290.        | 5. L           | 0.50        | 490.                    | 470.                    | 0.                      |
| 06 01 14 | 1600.0       | 1390.        | 1390.        | 5. L           | 0.75        | 540.                    | 550.                    | 0.                      |

| DATE     | CALCIUM<br>MG(CA)/L | MAGNESIUM<br>MG(MG)/L | HARDNESS<br>MG(CACO3)/L | MANGANESE<br>MG(MN)/L | IRON<br>MG(Fe)/L | POTASSIUM<br>MG(K)/L | SODIUM<br>MG(Na)/L | DO<br>MG(O2)/L | TURBIDITY<br>NTU |
|----------|---------------------|-----------------------|-------------------------|-----------------------|------------------|----------------------|--------------------|----------------|------------------|
| 05 07 04 | 25.                 | 221.                  | 972.                    | 0.05                  | 0.14             | 32.                  | 53.                | 9.9            | 0.20             |
| 05 07 11 | 22.                 | 213.                  | 931.                    | 0.04                  | 0.14             | 32.                  | ---                | 10.4           | 1.00             |
| 05 07 18 | ---                 | ---                   | ---                     | ---                   | ---              | ---                  | ---                | ---            | ---              |
| 05 07 25 | 21.                 | 200.                  | 876.                    | 0.05                  | 0.14             | 33.                  | 53.                | ---            | 1.50             |
| 05 08 01 | 21.                 | 200.                  | 876.                    | 0.04                  | 0.14             | 34.                  | 49.                | 7.7            | 1.00             |
| 05 08 09 | 22.                 | 220.                  | 960.                    | 0.04                  | 0.14             | 35.                  | 40.                | 7.6            | 0.75             |
| 05 08 16 | 21.                 | 226.                  | 960.                    | 0.15                  | 0.14             | 34.                  | 47.                | 7.0            | 1.00             |
| 05 08 22 | 22.                 | 213.                  | 932.                    | 0.04                  | 0.14             | 35.                  | 49.                | 7.4            | 0.23             |
| 05 08 27 | 20.                 | 199.                  | 832.                    | 0.04                  | 0.13             | 33.                  | 50.                | 7.5            | 1.00             |
| 05 08 31 | 23.                 | 227.                  | 991.                    | 0.03                  | 0.06             | 36.                  | 40.                | 10.4           | 1.50             |
| 06 01 14 | 24.                 | 205.                  | 903.                    | 0.04                  | 0.06             | 36.                  | 40.                | 7.3            | 1.00             |

| DATE     | SILICA<br>MG(SIO2)/L | TEU<br>MG(TU)/L | NO3 + NO2<br>MG(N)/L | NO3-NO2<br>MG(N)/L | P-TOTAL<br>MG(P)/L | CHLORIDE<br>MG(CL)/L | SULFATE<br>MG(SO4)/L | CHLORO-A<br>US/L | T. COLI<br>MPN/100 ML |
|----------|----------------------|-----------------|----------------------|--------------------|--------------------|----------------------|----------------------|------------------|-----------------------|
| 05 07 04 | 0.3                  | 2.30            | 0.01                 | 0.01 L             | 0.030              | 7.                   | 515.                 | 10.5             | 4                     |
| 05 07 11 | 0.4                  | 2.00            | 0.01                 | 0.01 L             | 0.025              | 8.                   | 510.                 | 2.9              | 0                     |
| 05 07 18 | ---                  | ---             | ---                  | ---                | ---                | ---                  | ---                  | ---              | 0                     |
| 05 07 25 | 0.9                  | 2.30            | 0.01                 | 0.01 L             | 0.025              | 9.                   | 506.                 | 4.7              | 0                     |
| 05 08 01 | 1.2                  | 2.30            | 0.01                 | 0.01 L             | 0.025              | 8.                   | 492.                 | 3.5              | 0                     |
| 05 08 09 | 1.5                  | 2.30            | 0.02                 | 0.01 L             | 0.025              | 9.                   | 516.                 | 3.9              | 0                     |
| 05 08 16 | 1.0                  | 2.30            | 0.03                 | 0.01 L             | 0.025              | 8.                   | 506.                 | 4.0              | 0                     |
| 05 08 22 | 2.0                  | 2.40            | 0.02                 | 0.01 L             | 0.030              | 9.                   | 453.                 | 11.4             | 21                    |
| 05 08 27 | 2.2                  | 2.30            | 0.01                 | 0.01 L             | 0.025              | 8.                   | 500.                 | 6.7              | 4                     |
| 05 08 31 | 2.2                  | 2.30            | 0.03                 | 0.02               | 0.030              | 9.                   | 506.                 | ---              | ---                   |
| 06 01 14 | 2.2                  | 2.00            | 0.15                 | 0.04               | 0.025              | 8.                   | 550.                 | ---              | ---                   |

DATE F. COLI  
MPN/100 ML

| DATE     | F. COLI<br>MPN/100 ML | SECCCHI DISC<br>METRES |
|----------|-----------------------|------------------------|
| 05 07 04 | 0                     | 2.50                   |
| 05 07 11 | 0                     | 2.10                   |
| 05 07 18 | 0                     | ---                    |
| 05 07 25 | 0                     | 2.40                   |
| 05 08 01 | 0                     | 2.00                   |
| 05 08 09 | 0                     | 2.00                   |
| 05 08 16 | 0                     | 1.90                   |
| 05 08 22 | 0                     | 1.60                   |
| 05 08 27 | 0                     | 1.60                   |
| 05 08 31 | ---                   | ---                    |
| 06 01 14 | ---                   | ---                    |

# Appendix IV(j-1)

STATION W20045, SOURCE - THREE LAKE  
SAMPLING LOCATION - E END LATITUDE 50:40 LONGITUDE 100:14

FROM 05 06 01  
TO 06 01 31

| DATE     | COND<br>US/CM | T.B.<br>MG/L | F.B.<br>MG/L | N.P.B.<br>MG/L | PH<br>UNITS | ALKALINITY<br>MG(CO3)/L | ALKALINITY<br>MG(CO3)/L | ALKALINITY<br>MG(CO3)/L | ALKALINITY<br>MG(CO3)/L |
|----------|---------------|--------------|--------------|----------------|-------------|-------------------------|-------------------------|-------------------------|-------------------------|
| 05 07 03 | 763.0         | 630.         | 630.         | 5.1            | 6.40        | 150.                    | 100.                    | 2.                      | 0.                      |
| 05 07 10 | 751.0         | 630.         | 630.         | 5.1            | 6.45        | 160.                    | 176.                    | 10.                     | 0.                      |
| 05 07 17 | 757.0         | 570.         | 570.         | 5.1            | 6.40        | 160.                    | 181.                    | 7.                      | 0.                      |
| 05 07 24 | 761.0         | 640.         | 640.         | 5.1            | 6.45        | 154.                    | 181.                    | 2.                      | 0.                      |
| 05 07 31 | 770.0         | 620.         | 620.         | 5.1            | 6.45        | 154.                    | 178.                    | 5.                      | 0.                      |
| 05 08 08 | 749.0         | 560.         | 560.         | 5.1            | 6.30        | 152.                    | 181.                    | 0.                      | 0.                      |
| 05 08 15 | 721.0         | 570.         | 570.         | 5.1            | 6.40        | 148.                    | 160.                    | 0.                      | 0.                      |
| 05 08 21 | 721.0         | 560.         | 560.         | 5.1            | 6.40        | 148.                    | 160.                    | 2.                      | 0.                      |
| 05 08 27 | 713.0         | 550.         | 550.         | 5.1            | 6.40        | 146.                    | 160.                    | 5.                      | 0.                      |
| 05 10 23 | 710.0         | 670.         | 670.         | 5.1            | 6.35        | 150.                    | 170.                    | 2.                      | 0.                      |
| 06 01 14 | 664.0         | 650.         | 650.         | 5.1            | 6.05        | 182.                    | 222.                    | 0.                      | 0.                      |

| DATE     | CALCIUM<br>MG(CA)/L | MAGNESIUM<br>MG(MG)/L | HARDNESS<br>MG(CACO3)/L | MANGANESE<br>MG(MN)/L | IRON<br>MG(Fe)/L | POTASSIUM<br>MG(K)/L | SODIUM<br>MG(Na)/L | DO<br>MG(O2)/L | TURBIDITY<br>NTU |
|----------|---------------------|-----------------------|-------------------------|-----------------------|------------------|----------------------|--------------------|----------------|------------------|
| 05 07 03 | 37.                 | 68.                   | 424.                    | 0.05                  | 0.02             | 50.                  | 7.                 | 8.0            | 0.95             |
| 05 07 10 | 62.                 | 70.                   | 400.                    | 0.11                  | 0.02             | 10.                  | 0.                 | 0.4            | 0.75             |
| 05 07 17 | 56.                 | 69.                   | 421.                    | 0.06                  | 0.02             | 11.                  | 7.                 | 7.5            | 0.50             |
| 05 07 24 | 57.                 | 71.                   | 415.                    | 0.06                  | 0.02             | 10.                  | 0.                 | 7.1            | 0.70             |
| 05 07 31 | 55.                 | 70.                   | 427.                    | 0.06                  | 0.02             | 10.                  | 0.                 | 7.1            | 0.70             |
| 05 08 08 | 55.                 | 72.                   | 432.                    | 0.05                  | 0.02             | 12.                  | 7.                 | 6.0            | 2.00             |
| 05 08 15 | 57.                 | 72.                   | 437.                    | 0.05                  | 0.02             | 11.                  | 6.                 | 9.3            | 0.50             |
| 05 08 21 | 59.                 | 64.                   | 384.                    | 0.05                  | 0.02             | 10.                  | 0.                 | 8.6            | 0.58             |
| 05 08 27 | 52.                 | 53.                   | 322.                    | 0.02                  | 0.02             | 12.                  | 7.                 | 11.0           | 1.09             |
| 05 10 23 | 57.                 | 60.                   | 424.                    | 0.02                  | 0.02             | 12.                  | 0.                 | 7.0            | 0.69             |

| DATE     | SILICA<br>MG(SIO2)/L | TDS<br>MG(T)/L | 1043 + 1044<br>MG(N)/L | NO3-NO2<br>MG(N)/L | P-TOTAL<br>MG(P)/L | CHLORIDE<br>MG(CL)/L | SULPHATE<br>MG(SO4)/L | CHLORIDE-A<br>MG/L | F-COLI<br>NTU/100 ML |
|----------|----------------------|----------------|------------------------|--------------------|--------------------|----------------------|-----------------------|--------------------|----------------------|
| 05 07 03 | 9.1                  | 1.30           | 0.05                   | 0.01               | 0.010              | 2.                   | 250.                  | 2.0                | 0                    |
| 05 07 10 | 0.0                  | 1.40           | 0.02                   | 0.01               | 0.010              | 2.                   | 250.                  | 5.3                | 4                    |
| 05 07 17 | 0.0                  | 1.40           | 0.02                   | 0.01               | 0.010              | 2.                   | 250.                  | 3.5                | 9                    |
| 05 07 24 | 0.0                  | 1.40           | 0.04                   | 0.01               | 0.010              | 2.                   | 250.                  | 2.0                | 0                    |
| 05 07 31 | 11.0                 | 1.10           | 0.06                   | 0.01               | 0.010              | 2.                   | 250.                  | 1.0                | 4                    |
| 05 08 08 | 11.0                 | 1.10           | 0.07                   | 0.01               | 0.010              | 2.                   | 250.                  | 2.0                | 7                    |
| 05 08 15 | 12.0                 | 1.10           | 0.08                   | 0.01               | 0.010              | 2.                   | 250.                  | 3.1                | 23                   |
| 05 08 21 | 12.0                 | 1.10           | 0.08                   | 0.01               | 0.010              | 2.                   | 250.                  | 3.1                | 0                    |
| 05 08 27 | 12.0                 | 1.10           | 0.06                   | 0.01               | 0.010              | 2.                   | 250.                  | 2.0                | 0                    |
| 05 10 23 | 13.0                 | 1.20           | 0.13                   | 0.01               | 0.010              | 2.                   | 220.                  | ---                | ---                  |
| 06 01 14 | 15.0                 | 1.50           | 0.41                   | 0.03               | 0.010              | 2.                   | 273.                  | ---                | ---                  |

| DATE     | F-COLI<br>NTU/100 ML | SECCHI DISC<br>METRES |
|----------|----------------------|-----------------------|
| 05 07 03 | 0                    | 2.90                  |
| 05 07 10 | 0                    | 3.30                  |
| 05 07 17 | 0                    | 2.00                  |
| 05 07 24 | 0                    | 2.70                  |
| 05 07 31 | 0                    | 3.50                  |
| 05 08 08 | 0                    | 2.90                  |
| 05 08 15 | 0                    | 3.00                  |
| 05 08 21 | 0                    | 2.70                  |
| 05 08 27 | 0                    | 3.00                  |
| 05 10 23 | ---                  | ---                   |
| 06 01 14 | ---                  | ---                   |

Appendix IV(j-ii)

STATION M8996, SOURCE - INWEE LAKE  
SAMPLING LOCATION - MIDDLE LATITUDE 50:40 LONGITUDE 100:14

FROM 05 06 01  
TO 06 01 31

| DATE     | COND<br>US/CM | T.R.<br>MG/L | F.R.<br>MG/L | N.F.R.<br>MG/L | PH<br>UNITS | ALKALINITY<br>MG/CAC03/L | ALKALINITY<br>MG/CO3/L | ALKALINITY<br>MG/CO3/L | ALKALINITY<br>MG/CO3/L |
|----------|---------------|--------------|--------------|----------------|-------------|--------------------------|------------------------|------------------------|------------------------|
| 05 07 03 | 743.0         | 466.         | 466.         | 5. L           | 6.40        | 150.                     | 160.                   | 8.                     | 0.                     |
| 05 07 10 | 785.0         | 466.         | 466.         | 5. L           | 6.20        | 162.                     | 150.                   | 0.                     | 0.                     |
| 05 07 17 | 785.0         | 470.         | 470.         | 5. L           | 6.30        | 150.                     | 170.                   | 0.                     | 0.                     |
| 05 07 24 | 776.0         | 470.         | 470.         | 5. L           | 6.30        | 150.                     | 170.                   | 0.                     | 0.                     |
| 05 07 31 | 776.0         | 470.         | 470.         | 5. L           | 6.30        | 150.                     | 170.                   | 0.                     | 0.                     |
| 05 08 06 | 749.0         | 568.         | 568.         | 5. L           | 6.40        | 150.                     | 170.                   | 0.                     | 0.                     |
| 05 08 13 | 710.0         | 570.         | 570.         | 5. L           | 6.30        | 140.                     | 180.                   | 0.                     | 0.                     |
| 05 08 21 | 710.0         | 590.         | 590.         | 5. L           | 6.30        | 140.                     | 170.                   | 0.                     | 0.                     |
| 05 08 27 | 710.0         | 540.         | 540.         | 5. L           | 6.45        | 140.                     | 160.                   | 0.                     | 0.                     |
| 05 10 23 | 710.0         | 600.         | 600.         | 5. L           | 6.30        | 140.                     | 170.                   | 0.                     | 0.                     |
| 06 01 14 | 647.0         | 659.         | 659.         | 5. L           | 6.00        | 160.                     | 229.                   | 0.                     | 0.                     |

| DATE     | CALCIUM<br>MG/CAL/L | MAGNESIUM<br>MG/MG/L | HARDNESS<br>MG/CAC03/L | IRON<br>MG/FE/L | POTASSIUM<br>MG/K/L | SODIUM<br>MG/NA/L | CO<br>MG/CO/L | TURBIDITY<br>NTU |
|----------|---------------------|----------------------|------------------------|-----------------|---------------------|-------------------|---------------|------------------|
| 05 07 03 | 57.                 | 67.                  | 437.                   | 0.02            | 10.                 | 7.                | 7.4           | 1.00             |
| 05 07 10 | 65.                 | 77.                  | 470.                   | 0.06            | 11.                 | 11.               | 6.6           | 1.00             |
| 05 07 17 | 50.                 | 70.                  | 437.                   | 0.02            | 11.                 | 0.                | 7.4           | 0.50             |
| 05 07 24 | 57.                 | 73.                  | 435.                   | 0.02            | 10.                 | 0.                | 7.4           | 0.50             |
| 05 07 31 | 57.                 | 77.                  | 443.                   | 0.02            | 11.                 | 0.                | 7.1           | 0.50             |
| 05 08 06 | 58.                 | 77.                  | 468.                   | 0.02            | 12.                 | 0.                | 6.0           | 0.75             |
| 05 08 13 | 50.                 | 73.                  | 443.                   | 0.05            | 10.                 | 7.                | 9.2           | 0.40             |
| 05 08 21 | 50.                 | 61.                  | 378.                   | 0.00            | 10.                 | 0.                | 11.8          | 0.45             |
| 05 08 27 | 50.                 | 54.                  | 327.                   | 0.02            | 12.                 | 7.                | 11.8          | 1.50             |
| 05 10 23 | 42.                 | 40.                  | 419.                   | 0.02            | 11.                 | 0.                | 3.3           | 0.65             |
| 06 01 14 | 57.                 | 40.                  | 419.                   | 0.02            | 11.                 | 0.                | 3.3           | 0.65             |

| DATE     | SILICA<br>MG/SIO2/L | THU<br>MG/TH/L | NO3 + NO2<br>MG/N/L | P-TOTAL<br>MG/P/L | CHLORIDE<br>MG/CL/L | SULPHATE<br>MG/SO4/L | CHLORIDE-A<br>MG/L | T. COLI<br>MPN/100 ML |
|----------|---------------------|----------------|---------------------|-------------------|---------------------|----------------------|--------------------|-----------------------|
| 05 07 03 | 9.1                 | 1.20           | 0.05                | 0.01              | 2.                  | 245.                 | 3.0                | 0                     |
| 05 07 10 | 10.0                | 1.10           | 0.11                | 0.01              | 2.                  | 245.                 | 24.0               | 0                     |
| 05 07 17 | 9.7                 | 1.20           | 0.04                | 0.01              | 3.                  | 253.                 | 12.2               | 0                     |
| 05 07 24 | 9.9                 | 1.20           | 0.05                | 0.01              | 2.                  | 240.                 | 0.7                | 0                     |
| 05 07 31 | 11.0                | 1.10           | 0.07                | 0.01              | 2.                  | 255.                 | 14.0               | 0                     |
| 05 08 06 | 11.0                | 1.10           | 0.06                | 0.01              | 2.                  | 250.                 | 6.1                | 0                     |
| 05 08 13 | 11.0                | 1.10           | 0.05                | 0.01              | 2.                  | 240.                 | 5.6                | 10                    |
| 05 08 21 | 11.0                | 1.10           | 0.06                | 0.01              | 2.                  | 240.                 | 2.2                | 0                     |
| 05 08 27 | 11.0                | 1.10           | 0.06                | 0.01              | 2.                  | 240.                 | 2.2                | 0                     |
| 05 10 23 | 13.0                | 1.20           | 0.13                | 0.01              | 2.                  | 240.                 | 2.2                | 0                     |
| 06 01 14 | 10.0                | 1.60           | 0.47                | 0.01              | 2.                  | 270.                 | 2.2                | 0                     |

| DATE     | F. COLI<br>MPN/100 ML | SECCHI DISC<br>METRES |
|----------|-----------------------|-----------------------|
| 05 07 03 | 0                     | 2.00                  |
| 05 07 10 | 0                     | 3.00                  |
| 05 07 17 | 0                     | 3.10                  |
| 05 07 24 | 0                     | 3.00                  |
| 05 07 31 | 0                     | 3.00                  |
| 05 08 06 | 0                     | 2.50                  |
| 05 08 13 | 4                     | 2.50                  |
| 05 08 21 | 0                     | 2.50                  |
| 05 08 27 | 0                     | 3.00                  |
| 05 10 23 | 0                     | 3.00                  |
| 06 01 14 | 0                     | ---                   |

Appendix IV(j-iii)

STATION W00927, SOURCE - JIRIE LAKE  
SAMPLING LOCATION - W RIG LATITUDE 50:48 LONGITUDE 100:14

FROM 05 04 01  
TO 06 01 31

| DATE     | COD<br>US/CH | T.R.<br>MG/L | F.P.<br>MG/L | N.T.R.<br>MG/L | PH<br>UNITS | ALKALINITY<br>MG/CAC03/L | ALKALINITY<br>MG/C03/L | ALKALINITY<br>MG/C03/L | ALKALINITY<br>MG/CH/L |
|----------|--------------|--------------|--------------|----------------|-------------|--------------------------|------------------------|------------------------|-----------------------|
| 05 07 03 | 743.0        | 610.         | 610.         | 5. L           | 8.30        | 160.                     | 195.                   | 0.                     | 0.                    |
| 05 07 10 | 751.0        | 640.         | 640.         | 5. L           | 8.50        | 160.                     | 185.                   | 0.                     | 0.                    |
| 05 07 17 | 747.0        | 570.         | 570.         | 5. L           | 8.40        | 154.                     | 185.                   | 5.                     | 0.                    |
| 05 07 24 | 769.0        | 600.         | 600.         | 5. L           | 8.30        | 154.                     | 170.                   | 5.                     | 0.                    |
| 05 07 31 | 778.0        | 610.         | 610.         | 5. L           | 8.30        | 152.                     | 165.                   | 0.                     | 0.                    |
| 05 08 08 | 738.0        | 570.         | 570.         | 5. L           | 8.30        | 156.                     | 163.                   | 0.                     | 0.                    |
| 05 08 15 | 710.0        | 570.         | 570.         | 5. L           | 8.45        | 142.                     | 168.                   | 2.                     | 0.                    |
| 05 08 21 | 710.0        | 570.         | 570.         | 5. L           | 8.55        | 144.                     | 161.                   | 7.                     | 0.                    |
| 05 08 27 | 721.0        | 600.         | 600.         | 5. L           | 8.45        | 140.                     | 176.                   | 2.                     | 0.                    |
| 05 10 23 | 710.0        | 600.         | 600.         | 5. L           | 8.45        | 164.                     | 176.                   | 0.                     | 0.                    |
| 05 01 14 | 847.0        | 650.         | 650.         | 5. L           | 8.05        | 164.                     | 224.                   | 0.                     | 0.                    |

| DATE     | CALCIUM<br>MG/CAL/L | MAGNESIUM<br>MG/MG/L | HARDNESS<br>MG/CAC03/L | MANGANESE<br>MG/NI/L | IRON<br>MG/FE/L | POTASSIUM<br>MG/K/L | SODIUM<br>MG/NA/L | DO<br>MG/O2/L | TURBIDITY<br>NTU |
|----------|---------------------|----------------------|------------------------|----------------------|-----------------|---------------------|-------------------|---------------|------------------|
| 05 07 03 | 58.                 | 67.                  | 618.                   | 0.05                 | 0.03            | 10.                 | 7.                | 7.6           | 0.65             |
| 05 07 10 | 58.                 | 70.                  | 648.                   | 0.06                 | 0.02            | 10.                 | 6.                | 6.6           | 0.70             |
| 05 07 17 | 58.                 | 72.                  | 436.                   | 0.07                 | 0.02            | 11.                 | 6.                | 7.0           | 0.43             |
| 05 07 24 | 58.                 | 72.                  | 439.                   | 0.06                 | 0.02            | 10.                 | 6.                | 7.0           | 1.50             |
| 05 07 31 | 57.                 | 75.                  | 439.                   | 0.07                 | 0.03            | 11.                 | 6.                | 7.9           | 0.70             |
| 05 08 08 | 58.                 | 78.                  | 454.                   | 0.08                 | 0.03            | 11.                 | 6.                | 7.6           | 1.50             |
| 05 08 15 | 59.                 | 71.                  | 460.                   | 0.06                 | 0.02            | 6.                  | 9.                | 7.8           | 0.49             |
| 05 08 21 | 53.                 | 71.                  | 423.                   | 0.06                 | 0.03            | 10.                 | 7.                | 9.4           | 1.03             |
| 05 08 27 | 57.                 | 74.                  | 440.                   | 0.09                 | 0.06            | 10.                 | 6.                | 8.6           | 1.70             |
| 05 10 23 | 43.                 | 55.                  | 331.                   | 0.02                 | 0.02            | 12.                 | 7.                | 11.6          | 1.03             |
| 06 01 14 | 62.                 | 73.                  | 455.                   | 0.02                 | 0.02            | 12.                 | 8.                | 9.1           | 0.65             |

| DATE     | SILICA<br>MG/SIO2/L | TPH<br>MG/NI/L | HA3 + HA4<br>MG/NI/L | HA3-HA2<br>MG/NI/L | P-TOTAL<br>MG/PI/L | CHLORIDE<br>MG/CL/L | SULPHATE<br>MG/SO4/L | CHLORO-A<br>US/L | T. COLI<br>MPN/100 HL |
|----------|---------------------|----------------|----------------------|--------------------|--------------------|---------------------|----------------------|------------------|-----------------------|
| 05 07 03 | 9.1                 | 1.20           | 0.36                 | 0.01               | 0.010              | 2.                  | 245.                 | 2.6              | 23                    |
| 05 07 10 | 9.6                 | 1.10           | 0.02                 | 0.01               | 0.015              | 2.                  | 255.                 | 73.4             | 4                     |
| 05 07 17 | 9.7                 | 1.20           | 0.04                 | 0.01               | 0.010              | 3.                  | 253.                 | 3.5              | 4                     |
| 05 07 24 | 9.9                 | 1.20           | 0.04                 | 0.01               | 0.020              | 2.                  | 253.                 | 6.9              | 0                     |
| 05 07 31 | 11.0                | 1.10           | 0.04                 | 0.01               | 0.015              | 2.                  | 258.                 | 2.6              | 21                    |
| 05 08 08 | 11.0                | 1.00           | 0.05                 | 0.01               | 0.030              | 2.                  | 259.                 | 2.2              | 4                     |
| 05 08 15 | 13.0                | 1.10           | 0.09                 | 0.01               | 0.015              | 2.                  | 230.                 | 2.9              | 9                     |
| 05 08 21 | 12.0                | 1.10           | 0.07                 | 0.01               | 0.015              | 2.                  | 243.                 | 1.6              | 4                     |
| 05 08 27 | 12.0                | 1.00           | 0.06                 | 0.01               | 0.015              | 2.                  | 240.                 | ---              | ---                   |
| 05 10 23 | 13.0                | 1.20           | 0.13                 | 0.04               | 0.015              | 2.                  | 240.                 | ---              | ---                   |
| 06 01 14 | 15.0                | 1.50           | 0.36                 | 0.03               | 0.005              | 2.                  | 273.                 | ---              | ---                   |

| DATE     | F. COLI<br>MPN/100 HL | SECCCHI DISC<br>METRES |
|----------|-----------------------|------------------------|
| 05 07 03 | 0                     | 3.50                   |
| 05 07 10 | 0                     | 3.20                   |
| 05 07 17 | 0                     | 3.50                   |
| 05 07 24 | 0                     | 3.00                   |
| 05 07 31 | 0                     | 3.00                   |
| 05 08 08 | 0                     | 2.90                   |
| 05 08 15 | 0                     | 3.00                   |
| 05 08 21 | 4                     | 2.00                   |
| 05 08 27 | ---                   | 3.90                   |
| 05 10 23 | ---                   | 3.50                   |
| 06 01 14 | ---                   | ---                    |

Appendix IV(k-1)

STATION 40940, SOURCE - SECH LAKE  
SAMPLING LOCATION - N END LATITUDE 50:40 LONGITUDE 100:20

FROM 85 06 31  
TO 86 01 31

| DATE     | COND<br>US/CM | T.R.<br>MG/L | F.R.<br>MG/L | H.F.R.<br>MG/L | PH<br>UNITS | ALKALINITY<br>MG/CAC03/L | ALKALINITY<br>MG/CA03/L | ALKALINITY<br>MG/CA03/L | ALKALINITY<br>MG/CA03/L |
|----------|---------------|--------------|--------------|----------------|-------------|--------------------------|-------------------------|-------------------------|-------------------------|
| 85 07 04 | 572.0         | 410.         | 410.         | 5.1            | 8.70        | 306.                     | 329.                    | 22.                     | 0.                      |
| 85 07 11 | 575.0         | 400.         | 400.         | 5.1            | 8.75        | 306.                     | 325.                    | 26.                     | 0.                      |
| 85 07 18 | 573.0         | 360.         | 360.         | 5.1            | 8.60        | 300.                     | 290.                    | 34.                     | 0.                      |
| 85 07 25 | 590.0         | 360.         | 360.         | 5.1            | 8.65        | 290.                     | 271.                    | 50.                     | 0.                      |
| 85 08 01 | 542.0         | 370.         | 370.         | 5.1            | 8.65        | 290.                     | 300.                    | 31.                     | 0.                      |
| 85 08 09 | 549.0         | 360.         | 360.         | 5.1            | 8.60        | 290.                     | 290.                    | 31.                     | 0.                      |
| 85 08 16 | 553.0         | 370.         | 370.         | 5.1            | 8.65        | 290.                     | 290.                    | 29.                     | 0.                      |
| 85 08 22 | 553.0         | 360.         | 360.         | 5.1            | 8.65        | 290.                     | 268.                    | 34.                     | 0.                      |
| 85 08 27 | 551.0         | 470.         | 470.         | 5.1            | 8.65        | 290.                     | 325.                    | 19.                     | 0.                      |
| 85 10 23 | 602.0         | 390.         | 390.         | 5.1            | 8.65        | 322.                     | 359.                    | 17.                     | 0.                      |
| 86 01 14 |               |              |              |                |             |                          |                         |                         |                         |

| DATE     | CALCIUM<br>MG/CA/L | MAGNESIUM<br>MG/MG/L | HARDNESS<br>MG/CAC03/L | MANGANESE<br>MG/MN/L | IRON<br>MG/FE/L | POTASSIUM<br>MG/K/L | SODIUM<br>MG/NA/L | DO<br>MG/O2/L | TURBIDITY<br>NTU |
|----------|--------------------|----------------------|------------------------|----------------------|-----------------|---------------------|-------------------|---------------|------------------|
| 85 07 04 | 30.                | 73.                  | 376.                   | 0.02                 | 0.04            | 13.                 | 0.                | 9.1           | 1.50             |
| 85 07 11 | 27.                | 68.                  | 346.                   | 0.02                 | 0.03            | 12.                 | 7.                | 9.4           | 0.65             |
| 85 07 18 | 27.                | 67.                  | 352.                   | 0.02                 | 0.02            | 12.                 | 7.                | 7.9           | 0.70             |
| 85 07 25 | 26.                | 60.                  | 345.                   | 0.02                 | 0.02            | 12.                 | 7.                | 7.9           | 0.70             |
| 85 08 01 | 27.                | 72.                  | 362.                   | 0.02                 | 0.02            | 12.                 | 7.                | 8.6           | 0.70             |
| 85 08 09 | 26.                | 71.                  | 359.                   | 0.02                 | 0.03            | 12.                 | 7.                | 8.0           | 0.70             |
| 85 08 16 | 27.                | 72.                  | 366.                   | 0.02                 | 0.02            | 12.                 | 6.                | 8.7           | 0.75             |
| 85 08 22 | 25.                | 67.                  | 335.                   | 0.02                 | 0.02            | 12.                 | 6.                | 8.6           | 1.00             |
| 85 08 27 | 25.                | 73.                  | 340.                   | 0.02                 | 0.02            | 13.                 | 7.                | 11.0          | 1.00             |
| 85 10 23 | 27.                | 70.                  | 350.                   | 0.02                 | 0.04            | 13.                 | 7.                | 7.3           | 0.75             |
| 86 01 14 | 29.                | 72.                  | 369.                   | 0.03                 | 0.04            | 13.                 |                   |               |                  |

| DATE     | SILICA<br>MG/SIO2/L | THAN<br>MG/TH/L | NO3 + NO2<br>MG/N/L | NO3-NO2<br>MG/N/L | P-TOTAL<br>MG/P/L | CHLORIDE<br>MG/CL/L | SULFATE<br>MG/SO4/L | CHLORO-A<br>US/L | T. COLI<br>MPN/100 ML |
|----------|---------------------|-----------------|---------------------|-------------------|-------------------|---------------------|---------------------|------------------|-----------------------|
| 85 07 04 | 0.7                 | 1.10            | 0.00                | 0.01              | 0.030             | 3.                  | 35.                 | 4.2              | 4                     |
| 85 07 11 | 0.2                 | 1.13            | 0.03                | 0.01              | 0.020             | 3.                  | 20.                 | 3.5              | 4                     |
| 85 07 18 | 0.2                 | 1.00            | 0.00                | 0.01              | 0.020             | 3.                  | 28.                 | 5.3              | 7                     |
| 85 07 25 | 0.2                 | 1.10            | 0.01                | 0.01              | 0.020             | 3.                  | 33.                 | 2.2              | 23                    |
| 85 08 01 | 0.3                 | 1.10            | 0.05                | 0.01              | 0.025             | 4.                  | 25.                 | 2.2              | 0                     |
| 85 08 09 | 0.5                 | 1.10            | 0.02                | 0.01              | 0.021             | 3.                  | 25.                 | 3.9              | 0                     |
| 85 08 16 | 0.2                 | 1.10            | 0.02                | 0.01              | 0.030             | 4.                  | 30.                 | 6.7              | 0                     |
| 85 08 22 | 0.2                 | 1.20            | 0.00                | 0.01              | 0.01              | 4.                  | 33.                 | 7.0              | 0                     |
| 85 08 27 | 0.2                 | 1.00            | 0.01                | 0.01              | 0.01              | 4.                  | 20.                 | ---              | ---                   |
| 85 10 23 | 0.2                 | 1.00            | 0.01                | 0.01              | 0.01              | 4.                  | 20.                 | ---              | ---                   |
| 86 01 14 | 0.2                 | 1.20            | 0.05                | 0.01              | 0.01              | 4.                  | 33.                 | ---              | ---                   |

DATE F. COLI SECOND DISC  
MPN/100 ML METRES

|          |     |      |
|----------|-----|------|
| 85 07 04 | 0   | 4.00 |
| 85 07 11 | 0   | 4.00 |
| 85 07 18 | 0   | ---  |
| 85 07 25 | 4   | 3.00 |
| 85 08 01 | 0   | 4.10 |
| 85 08 09 | 0   | 4.00 |
| 85 08 16 | 0   | 2.40 |
| 85 08 22 | 0   | 2.90 |
| 85 08 27 | 0   | 2.60 |
| 85 10 23 | --- | 3.50 |
| 86 01 14 | --- | ---  |

Appendix IV(k-11)

STATION W9301, SOURCE - SECH LAKE  
SAMPLING LOCATION - MIDDLE LATITUDE 50:40 LONGITUDE 100:20

FROM 05 06 01  
TO 06 01 31

| DATE     | COND<br>US/CM | T.R.<br>MG/L | F.R.<br>MG/L | N.P.R.<br>MG/L | PH<br>UNITS | ALPHEINITY<br>MG/CAC03/L | ALPHEINITY<br>MG/HC03/L | ALPHEINITY<br>MG/CO3/L | ALPHEINITY<br>MG/CM/L |
|----------|---------------|--------------|--------------|----------------|-------------|--------------------------|-------------------------|------------------------|-----------------------|
| 05 07 04 | 579.0         | 480.         | 480.         | 5. L           | 6.40        | 302.                     | 334.                    | 37.                    | 0.                    |
| 05 07 11 | 576.0         | 390.         | 390.         | 5. L           | 6.70        | 304.                     | 327.                    | 19.                    | 0.                    |
| 05 07 18 | 576.0         | 378.         | 378.         | 5. L           | 6.40        | 308.                     | 329.                    | 33.                    | 0.                    |
| 05 08 05 | 575.0         | 390.         | 390.         | 5. L           | 6.70        | 308.                     | 327.                    | 19.                    | 0.                    |
| 05 08 09 | 588.0         | 368.         | 368.         | 5. L           | 6.60        | 302.                     | 318.                    | 24.                    | 0.                    |
| 05 08 16 | 547.0         | 390.         | 390.         | 5. L           | 6.40        | 296.                     | 318.                    | 24.                    | 0.                    |
| 05 08 22 | 508.0         | 430.         | 400.         | 38.            | 6.45        | 266.                     | 334.                    | 7.                     | 0.                    |
| 05 08 27 | 546.0         | 380.         | 380.         | 5. L           | 6.45        | 290.                     | 290.                    | 34.                    | 0.                    |
| 05 10 23 | 551.0         | 490.         | 490.         | 5. L           | 6.80        | 290.                     | 344.                    | 19.                    | 0.                    |
| 06 01 14 | 597.0         | 300.         | 300.         | 5. L           | 6.70        | 310.                     | 344.                    | 27.                    | 0.                    |

| DATE     | CALCIUM<br>MG/CA/L | MAGNESIUM<br>MG/MG/L | HARDNESS<br>MG/CAC03/L | HARDNESS<br>MG/ML/L | IRON<br>MG/FE/L | POTASSIUM<br>MG/K/L | SODIUM<br>MG/NA/L | DO<br>MG/DE/L | TURBIDITY<br>NTU |
|----------|--------------------|----------------------|------------------------|---------------------|-----------------|---------------------|-------------------|---------------|------------------|
| 05 07 04 | 36.                | 73.                  | 373.                   | 0.11                | 0.04            | 13.                 | 0.                | 0.4           | 1.00             |
| 05 07 11 | 27.                | 67.                  | 301.                   | 0.03                | 0.04            | 12.                 | 7.                | 10.0          | 0.00             |
| 05 07 18 | 27.                | 71.                  | 308.                   | 0.02                | 0.02            | 12.                 | 6.                | 0.1           | 0.00             |
| 05 08 05 | 27.                | 67.                  | 308.                   | 0.02                | 0.02            | 12.                 | 7.                | 0.1           | 0.70             |
| 05 08 09 | 28.                | 71.                  | 359.                   | 0.02                | 0.03            | 12.                 | 7.                | 7.5           | 1.00             |
| 05 08 16 | 25.                | 67.                  | 343.                   | 0.02 L              | 0.03            | 12.                 | 7.                | 0.4           | 0.00             |
| 05 08 22 | 27.                | 72.                  | 363.                   | 0.03                | 0.02            | 12.                 | 7.                | 7.9           | 0.00             |
| 05 08 27 | 25.                | 65.                  | 327.                   | 0.03                | 0.02            | 12.                 | 9.                | 0.0           | 15.00            |
| 05 10 23 | 27.                | 73.                  | 360.                   | 0.02 L              | 0.02            | 13.                 | 7.                | 10.0          | 1.00             |
| 06 01 14 | 29.                | 72.                  | 330.                   | 0.02                | 0.04            | 13.                 | 7.                | 10.4          | 0.55             |

| DATE     | SILICA<br>MG/SIO2/L | THM<br>MG/THM/L | NO3 + NO2<br>MG/NO3/L | NO3-NO2<br>MG/NO3/L | P-TOTAL<br>MG/P/L | CHLORIDE<br>MG/CL/L | SULPHATE<br>MG/SO4/L | CHLOROP-A<br>MG/L | T-COLI<br>MPN/100 ML |
|----------|---------------------|-----------------|-----------------------|---------------------|-------------------|---------------------|----------------------|-------------------|----------------------|
| 05 07 04 | 0.0                 | 1.00            | 0.01                  | 0.01 L              | 0.030             | 3.                  | 30.                  | 1.0               | 23                   |
| 05 07 11 | 0.2                 | 0.90            | 0.03                  | 0.01 L              | 0.020             | 3.                  | 20.                  | 3.0               | 0                    |
| 05 07 18 | 0.2 L               | 1.00            | 0.01                  | 0.01 L              | 0.020             | 3.                  | 25.                  | 3.0               | 0                    |
| 05 08 05 | 0.3                 | 1.00            | 0.01                  | 0.01 L              | 0.020             | 3.                  | 25.                  | 4.0               | 0                    |
| 05 08 09 | 0.2                 | 1.00            | 0.01                  | 0.01 L              | 0.020             | 3.                  | 25.                  | 3.1               | 0                    |
| 05 08 16 | 0.4                 | 1.00            | 0.02                  | 0.01 L              | 0.020             | 4.                  | 33.                  | 3.1               | 0                    |
| 05 08 22 | 0.2                 | 1.10            | 0.02                  | 0.01 L              | 0.020             | 3.                  | 23.                  | 4.0               | 43                   |
| 05 08 27 | 0.2 L               | 0.90            | 0.01                  | 0.01 L              | 0.030             | 4.                  | 36.                  | 7.0               | 0                    |
| 05 10 23 | 0.2 L               | 1.00            | 0.01                  | 0.01 L              | 0.030             | 4.                  | 25.                  | 0.0               | ---                  |
| 06 01 14 | 0.2 L               | 1.70            | 0.00                  | 0.02                | 0.030             | 4.                  | 28.                  | ---               | ---                  |

| DATE     | P-COLI<br>MPN/100 ML | SPECIFIC DISC<br>METRES |
|----------|----------------------|-------------------------|
| 05 07 04 | 0                    | 4.20                    |
| 05 07 11 | 0                    | 3.00                    |
| 05 07 18 | 0                    | 3.00                    |
| 05 08 05 | 0                    | 0.00                    |
| 05 08 09 | 0                    | 4.00                    |
| 05 08 16 | 0                    | 4.10                    |
| 05 08 22 | 0                    | 2.50                    |
| 05 08 27 | 0                    | 2.50                    |
| 05 10 23 | ---                  | ---                     |
| 06 01 14 | ---                  | ---                     |

Appendix IV(k-111)

STATION 000000, SOURCE - MICH LAKE  
SAMPLING LOCATION - S END LATITUDE 55°48' LONGITUDE 100°28'

FROM 05 00 01  
TO 06 01 31

| DATE     | COND<br>US/CM | T.S.<br>MG/L | F.S.<br>MG/L | M.F.P.<br>MG/L | PM<br>PM UNITS | ALKALINITY<br>MG/CAC/1/L | ALKALINITY<br>MG/CO3/1/L | ALKALINITY<br>MG/CO3/1/L |
|----------|---------------|--------------|--------------|----------------|----------------|--------------------------|--------------------------|--------------------------|
| 05 07 04 | 877.0         | 400.         | 400.         | S. L           | 0.75           | 302.                     | 370.                     | 24.                      |
| 05 07 11 | 500.0         | 350.         | 350.         | S. L           | 0.75           | 300.                     | 317.                     | 24.                      |
| 05 07 18 | 576.0         | 370.         | 370.         | S. L           | 0.90           | 290.                     | 265.                     | 30.                      |
| 05 07 25 | 804.0         | 350.         | 350.         | S. L           | 0.90           | 290.                     | 303.                     | 29.                      |
| 05 08 01 | 540.0         | 340.         | 340.         | S. L           | 0.85           | 290.                     | 317.                     | 26.                      |
| 05 08 09 | 540.0         | 340.         | 340.         | S. L           | 0.85           | 290.                     | 317.                     | 26.                      |
| 05 08 16 | 849.0         | 350.         | 350.         | S. L           | 0.90           | 290.                     | 290.                     | 29.                      |
| 05 08 22 | 540.0         | 370.         | 370.         | S. L           | 0.85           | 290.                     | 303.                     | 29.                      |
| 05 08 27 | 540.0         | 340.         | 340.         | S. L           | 0.90           | 290.                     | 265.                     | 34.                      |
| 05 08 23 | 554.0         | 500.         | 500.         | S. L           | 0.90           | 304.                     | 320.                     | 19.                      |
| 06 01 10 | 591.0         | 340.         | 340.         | S. L           | 0.75           | 310.                     | 342.                     | 22.                      |

| DATE     | CALCIUM<br>MG/CA/1/L | MAGNESIUM<br>MG/MG/1/L | HARDNESS<br>MG/CA/CO3/1/L | PHOSPHATE<br>MG/PO4/1/L | IRON<br>MG/FE/1/L | POTASSIUM<br>MG/K/1/L | SODIUM<br>MG/NA/1/L | DO<br>MG/O2/1/L | TEMPERATURE<br>HTU |
|----------|----------------------|------------------------|---------------------------|-------------------------|-------------------|-----------------------|---------------------|-----------------|--------------------|
| 05 07 04 | 29.                  | 72.                    | 340.                      | 0.00                    | 0.03              | 13.                   | 0.                  | 9.2             | 1.00               |
| 05 07 11 | 26.                  | 67.                    | 341.                      | 0.03                    | 0.02              | 12.                   | 7.                  | 9.0             | 0.00               |
| 05 07 18 | 27.                  | 71.                    | 359.                      | 0.02                    | 0.02              | 12.                   | 7.                  | 9.2             | 0.00               |
| 05 07 25 | 27.                  | 71.                    | 359.                      | 0.02                    | 0.02              | 12.                   | 7.                  | 9.2             | 0.00               |
| 05 08 01 | 26.                  | 67.                    | 340.                      | 0.03                    | 0.03              | 12.                   | 7.                  | 9.0             | 1.00               |
| 05 08 09 | 27.                  | 72.                    | 342.                      | 0.02                    | 0.02              | 12.                   | 7.                  | 9.0             | 0.55               |
| 05 08 16 | 25.                  | 67.                    | 339.                      | 0.02                    | 0.04              | 13.                   | 7.                  | 9.1             | 0.70               |
| 05 08 22 | 27.                  | 72.                    | 361.                      | 0.02                    | 0.02              | 12.                   | 7.                  | 9.0             | 1.00               |
| 05 08 27 | 25.                  | 65.                    | 320.                      | 0.02                    | 0.02              | 12.                   | 0.                  | 9.1             | 0.00               |
| 05 08 23 | 27.                  | 72.                    | 353.                      | 0.02                    | 0.02              | 13.                   | 7.                  | 11.0            | 0.95               |
| 06 01 10 | 26.                  | 65.                    | 330.                      | 0.02                    | 0.03              | 13.                   | 7.                  | 10.1            | 0.70               |

| DATE     | SILICA<br>MG/SIO2/1/L | TRN<br>MG/NI/1/L | NO3 + NO2<br>MG/NI/1/L | P-TOTAL<br>MG/P/1/L | CHLORIDE<br>MG/CL/1/L | SULPHATE<br>MG/SO4/1/L | CHLORO-A<br>MG/L | T-COL<br>MPN/100 ML |
|----------|-----------------------|------------------|------------------------|---------------------|-----------------------|------------------------|------------------|---------------------|
| 05 07 04 | 0.7                   | 0.95             | 0.00                   | 0.030               | 3.                    | 30.                    | 2.0              | 4                   |
| 05 07 11 | 0.6                   | 0.90             | 0.01                   | 0.020               | 3.                    | 25.                    | 4.0              | 0                   |
| 05 07 18 | 0.6                   | 0.90             | 0.01                   | 0.020               | 3.                    | 25.                    | 4.0              | 0                   |
| 05 07 25 | 0.6                   | 1.00             | 0.01                   | 0.015               | 3.                    | 35.                    | 4.0              | 0                   |
| 05 08 01 | 0.2                   | 1.00             | 0.01                   | 0.010               | 3.                    | 20.                    | 2.0              | 4                   |
| 05 08 09 | 0.2                   | 1.00             | 0.01                   | 0.025               | 4.                    | 33.                    | 2.0              | 1000 0              |
| 05 08 16 | 0.4                   | 1.00             | 0.01                   | 0.025               | 3.                    | 23.                    | 3.5              | 4                   |
| 05 08 22 | 0.2                   | 1.10             | 0.02                   | 0.035               | 4.                    | 30.                    | 7.0              | 0                   |
| 05 08 27 | 0.2                   | 0.95             | 0.00                   | 0.025               | 4.                    | 25.                    | 7.0              | 0                   |
| 05 08 23 | 0.2                   | 1.00             | 0.01                   | 0.025               | 4.                    | 25.                    | 7.0              | 0                   |
| 06 01 10 | 0.2                   | 1.00             | 0.05                   | 0.015               | 4.                    | 25.                    | 7.0              | 0                   |

| DATE     | F-COL<br>MPN/100 ML | SECCHI DISC<br>METRES |
|----------|---------------------|-----------------------|
| 05 07 04 | 0                   | 4.00                  |
| 05 07 11 | 0                   | 4.00                  |
| 05 07 18 | 0                   | 3.30                  |
| 05 07 25 | 0                   | 4.20                  |
| 05 08 01 | 0                   | 3.40                  |
| 05 08 09 | 0                   | 3.00                  |
| 05 08 16 | 0                   | 2.40                  |
| 05 08 22 | 0                   | 2.00                  |
| 05 08 27 | 0                   | 2.00                  |
| 05 08 23 | 0                   | 4.00                  |
| 06 01 10 | ---                 | ---                   |

# Appendix IV(1-i)

STATION W0948, SOURCE - STEWART LAKE  
 SAMPLING LOCATION - N EID LATITUDE 50:30 LONGITUDE 100:16

FROM 05 04 01  
 TO 06 01 31

| DATE     | COND<br>US/CM | T.R.<br>MG/L | F.R.<br>MG/L | H.F.R.<br>MG/L | PH<br>UNITS | ALPHEALITY<br>MG/CM <sup>3</sup> /L | ALPHEALITY<br>MG/CM <sup>3</sup> /L | ALKALINITY<br>MG/CM <sup>3</sup> /L | ALKALINITY<br>MG/CM <sup>3</sup> /L |
|----------|---------------|--------------|--------------|----------------|-------------|-------------------------------------|-------------------------------------|-------------------------------------|-------------------------------------|
| 05 07 03 | 797.0         | 640.         | 640.         | S. L           | 6.40        | 166.                                | 207.                                | 10.                                 | 0.                                  |
| 05 07 10 | 796.0         | 630.         | 630.         | S. L           | 6.75        | 162.                                | 193.                                | 14.                                 | 0.                                  |
| 05 07 16 | 814.0         | 610.         | 610.         | S. L           | 6.70        | 182.                                | 193.                                | 14.                                 | 0.                                  |
| 05 07 24 | 817.0         | 600.         | 600.         | S. L           | 6.65        | 184.                                | 200.                                | 12.                                 | 0.                                  |
| 05 07 31 | 760.0         | 590.         | 590.         | S. L           | 6.60        | 176.                                | 171.                                | 22.                                 | 0.                                  |
| 05 08 08 | 751.0         | 558.         | 558.         | S. L           | 6.60        | 170.                                | 170.                                | 14.                                 | 0.                                  |
| 05 08 15 | 743.0         | 610.         | 610.         | S. L           | 6.70        | 168.                                | 171.                                | 17.                                 | 0.                                  |
| 05 08 23 | 754.0         | 520.         | 520.         | S. L           | 6.75        | 172.                                | 166.                                | 12.                                 | 0.                                  |
| 05 08 27 | 752.0         | 600.         | 600.         | S. L           | 6.75        | 172.                                | 181.                                | 14.                                 | 0.                                  |
| 05 10 23 | 847.0         | 640.         | 640.         | S. L           | 6.30        | 202.                                | 240.                                | 0.                                  | 0.                                  |
| 06 01 14 |               |              |              |                |             |                                     |                                     |                                     |                                     |

| DATE     | CALCIUM<br>MG/CM <sup>3</sup> /L | MAGNESIUM<br>MG/CM <sup>3</sup> /L | HARDNESS<br>MG/CM <sup>3</sup> /L | MANGANESE<br>MG/CM <sup>3</sup> /L | IRON<br>MG/CM <sup>3</sup> /L | POTASSIUM<br>MG/CM <sup>3</sup> /L | SODIUM<br>MG/CM <sup>3</sup> /L | DO<br>MG/CM <sup>3</sup> /L | TURBIDITY<br>NTU |
|----------|----------------------------------|------------------------------------|-----------------------------------|------------------------------------|-------------------------------|------------------------------------|---------------------------------|-----------------------------|------------------|
| 05 07 03 | 46.                              | 74.                                | 423.                              | 0.03                               | 0.03                          | 17.                                | 13.                             | 8.8                         | 1.00             |
| 05 07 10 | 51.                              | 81.                                | 461.                              | 0.05                               | 0.02                          | 17.                                | 15.                             | 9.1                         | 0.50             |
| 05 07 16 | 47.                              | 79.                                | 462.                              | 0.06                               | 0.02                          | 16.                                | 14.                             | 7.8                         | 1.02             |
| 05 07 24 | 46.                              | 78.                                | 463.                              | 0.05                               | 0.02                          | 16.                                | 14.                             | 7.8                         | 1.50             |
| 05 07 31 | 46.                              | 78.                                | 436.                              | 0.05                               | 0.02                          | 16.                                | 15.                             | 9.9                         | 1.50             |
| 05 08 08 | 47.                              | 66.                                | 463.                              | 0.09                               | 0.03                          | 20.                                | 15.                             | 7.0                         | 1.50             |
| 05 08 15 | 46.                              | 66.                                | 474.                              | 0.05                               | 0.04                          | 18.                                | 16.                             | 6.4                         | 1.00             |
| 05 08 21 | 44.                              | 79.                                | 437.                              | 0.05                               | 0.05                          | 18.                                | 14.                             | 9.2                         | 1.03             |
| 05 08 23 | 46.                              | 62.                                | 454.                              | 0.02                               | 0.05                          | 17.                                | 14.                             | 8.8                         | 0.65             |
| 05 10 23 | 46.                              | 63.                                | 457.                              | 0.02                               | 0.02                          | 18.                                | 15.                             | 11.7                        | 0.55             |
| 06 01 14 | 46.                              | 77.                                | 431.                              | 0.06                               | 0.02                          | 20.                                | 14.                             | 8.6                         | 0.20             |

| DATE     | SILICA<br>MG/CM <sup>3</sup> /L | TKN<br>MG/CM <sup>3</sup> /L | FM3 + FM4<br>MG/CM <sup>3</sup> /L | NO3-NO2<br>MG/CM <sup>3</sup> /L | P-TOTAL<br>MG/CM <sup>3</sup> /L | CHLORIDE<br>MG/CM <sup>3</sup> /L | SULPHATE<br>MG/CM <sup>3</sup> /L | CHLORO-A<br>US/L | T. COLI<br>MPN/100 ML |
|----------|---------------------------------|------------------------------|------------------------------------|----------------------------------|----------------------------------|-----------------------------------|-----------------------------------|------------------|-----------------------|
| 05 07 03 | 11.0                            | 1.00                         | 0.02                               | 0.01                             | 0.020                            | 3.                                | 245.                              | 5.0              | 93                    |
| 05 07 10 | 11.0                            | 1.10                         | 0.01                               | 0.01                             | 0.025                            | 3.                                | 240.                              | 10.5             | 4                     |
| 05 07 16 | 12.0                            | 1.30                         | 0.06                               | 0.07                             | 0.040                            | 3.                                | 240.                              | 6.7              | 0                     |
| 05 07 24 | 10.0                            | 1.30                         | 0.02                               | 0.01                             | 0.035                            | 4.                                | 250.                              | 10.5             | 9                     |
| 05 07 31 | 13.0                            | 1.30                         | 0.03                               | 0.01                             | 0.035                            | 4.                                | 250.                              | 10.5             | 15                    |
| 05 08 08 | 14.0                            | 1.20                         | 0.02                               | 0.01                             | 0.035                            | 4.                                | 243.                              | 0.7              | 9                     |
| 05 08 15 | 15.0                            | 1.20                         | 0.02                               | 0.01                             | 0.035                            | 3.                                | 243.                              | 10.5             | 4                     |
| 05 08 21 | 16.0                            | 1.20                         | 0.01                               | 0.01                             | 0.025                            | 4.                                | 240.                              | 7.0              | 9                     |
| 05 08 23 | 14.0                            | 1.30                         | 0.00                               | 0.01                             | 0.020                            | 5.                                | 230.                              | ---              | 0                     |
| 05 10 23 | 14.0                            | 1.43                         | 0.14                               | 0.02                             | 0.015                            | 4.                                | 270.                              | ---              | ---                   |
| 06 01 14 |                                 |                              |                                    |                                  |                                  |                                   |                                   |                  |                       |

DATE F. COLI SECCO DISC  
 MPN/100 ML METRES

|          |     |      |
|----------|-----|------|
| 05 07 03 | 0   | 3.00 |
| 05 07 10 | 0   | 3.00 |
| 05 07 16 | 0   | 2.10 |
| 05 07 24 | 0   | 1.60 |
| 05 07 31 | 0   | 1.10 |
| 05 08 08 | 0   | 1.30 |
| 05 08 15 | 0   | 1.40 |
| 05 08 21 | 4   | 1.60 |
| 05 08 23 | 0   | 1.50 |
| 05 10 23 | --- | 3.00 |
| 06 01 14 | --- | ---  |

Appendix IV(1-11)

STATION M70949, SOURCE - STEWART LAKE  
SAMPLING LOCATION - MIDDLE LATITUDE 50:38 LONGITUDE 100:16

FROM 05 06 01  
TO 06 01 31

| DATE     | COND<br>US/CM | T.R.<br>MG/L | F.R.<br>MG/L | H.F.R.<br>MG/L | PH<br>UNITS | ALCALINITY<br>MG/CAC03/L | ALCALINITY<br>MG/HC03/L | ALCALINITY<br>MG/CO3/L | ALCALINITY<br>MG/CO3/L |
|----------|---------------|--------------|--------------|----------------|-------------|--------------------------|-------------------------|------------------------|------------------------|
| 05 07 03 | 797.0         | 640.         | 640.         | 5. L           | 8.0         | 104.                     | 205.                    | 10.                    | 0.                     |
| 05 07 10 | 796.0         | 640.         | 640.         | 5. L           | 8.15        | 102.                     | 170.                    | 22.                    | 0.                     |
| 05 07 24 | 607.0         | 620.         | 620.         | 5. L           | 9.00        | 150.                     | 105.                    | 17.                    | 0.                     |
| 05 07 31 | 603.0         | 640.         | 630.         | 4. L           | 9.00        | 170.                     | 105.                    | 20.                    | 0.                     |
| 05 08 03 | 760.0         | 590.         | 590.         | 5. L           | 8.75        | 170.                     | 171.                    | 12.                    | 0.                     |
| 05 08 15 | 751.0         | 590.         | 590.         | 5. L           | 8.75        | 170.                     | 171.                    | 12.                    | 0.                     |
| 05 08 21 | 734.0         | 590.         | 590.         | 5. L           | 8.80        | 166.                     | 171.                    | 12.                    | 0.                     |
| 05 08 27 | 743.0         | 560.         | 560.         | 5. L           | 8.95        | 170.                     | 168.                    | 19.                    | 0.                     |
| 05 10 23 | 752.0         | 680.         | 650.         | 5. L           | 8.65        | 174.                     | 183.                    | 16.                    | 0.                     |
| 06 01 14 | 689.0         | 670.         | 670.         | 5. L           | 8.30        | 204.                     | 249.                    | 16.                    | 0.                     |

| DATE     | CALCIUM<br>MG/CA/L | MAGNESIUM<br>MG/MG/L | HARDNESS<br>MG/CAC03/L | MANGANESE<br>MG/MN/L | IRON<br>MG/FE/L | POTASSIUM<br>MG/K/L | SODIUM<br>MG/NA/L | DO<br>MG/O2/L | TURBIDITY<br>NTU |
|----------|--------------------|----------------------|------------------------|----------------------|-----------------|---------------------|-------------------|---------------|------------------|
| 05 07 03 | 40.                | 75.                  | 430.                   | 0.03                 | 0.03            | 17.                 | 16.               | 0.7           | 1.00             |
| 05 07 10 | 50.                | 81.                  | 457.                   | 0.05                 | 0.02 L          | 17.                 | 15.               | 0.7           | 0.65             |
| 05 07 24 | 48.                | 80.                  | 440.                   | 0.05                 | 0.02 L          | 16.                 | 15.               | 7.0           | 1.03             |
| 05 07 31 | 45.                | 79.                  | 430.                   | 0.05                 | 0.02 L          | 16.                 | 15.               | 10.0          | 2.53             |
| 05 08 03 | 47.                | 84.                  | 465.                   | 0.04                 | 0.02 L          | 16.                 | 15.               | 0.0           | 1.03             |
| 05 08 15 | 40.                | 66.                  | 470.                   | 0.05                 | 0.02 L          | 20.                 | 16.               | 0.6           | 1.03             |
| 05 08 21 | 44.                | 79.                  | 433.                   | 0.04                 | 0.02 L          | 16.                 | 14.               | 9.2           | 1.00             |
| 05 08 27 | 46.                | 82.                  | 452.                   | 0.04                 | 0.02 L          | 17.                 | 14.               | 0.5           | 1.00             |
| 05 10 23 | 47.                | 85.                  | 470.                   | 0.02                 | 0.02            | 16.                 | 14.               | 11.3          | 1.00             |
| 06 01 14 | 47.                | 77.                  | 435.                   | 0.05                 | 0.02            | 20.                 | 15.               | 0.7           | 0.55             |

| DATE     | SILICA<br>MG/SIO2/L | TKN<br>MG/N/L | NO3 + NO2<br>MG/N/L | NO3-NO2<br>MG/N/L | P-TOTAL<br>MG/P/L | CHLORIDE<br>MG/CL/L | SULPHATE<br>MG/SO4/L | CHLOROP-A<br>MG/L | T-COLI<br>MPN/100 ML |
|----------|---------------------|---------------|---------------------|-------------------|-------------------|---------------------|----------------------|-------------------|----------------------|
| 05 07 03 | 11.0                | 1.20          | 0.01                | 0.01 L            | 0.020             | 3.                  | 245.                 | 4.4               | 0                    |
| 05 07 10 | 9.4                 | 1.10          | 0.01                | 0.01 L            | 0.025             | 3.                  | 243.                 | 7.9               | 0                    |
| 05 07 24 | 13.0                | 1.20          | 0.01                | 0.01 L            | 0.035             | 4.                  | 235.                 | 10.5              | 0                    |
| 05 07 31 | 13.0                | 1.30          | 0.00                | 0.01 L            | 0.030             | 4.                  | 255.                 | 7.0               | 19                   |
| 05 08 03 | 14.0                | 1.30          | 0.01                | 0.01 L            | 0.030             | 4.                  | 250.                 | 6.1               | 0                    |
| 05 08 15 | 14.0                | 1.10          | 0.01                | 0.01 L            | 0.030             | 4.                  | 255.                 | 7.0               | 4                    |
| 05 08 21 | 14.0                | 1.20          | 0.02                | 0.01 L            | 0.025             | 3.                  | 230.                 | 5.3               | 0                    |
| 05 08 27 | 14.0                | 1.20          | 0.00                | 0.01 L            | 0.020             | 4.                  | 240.                 | 7.9               | 0                    |
| 05 10 23 | 13.0                | 1.30          | 0.01                | 0.01 L            | 0.030             | 5.                  | 230.                 | ---               | ---                  |
| 06 01 14 | 15.0                | 1.50          | 0.12                | 0.02              | 0.020             | 4.                  | 270.                 | ---               | ---                  |

| DATE     | F-COLI<br>MPN/100 ML | SECCCHI DISC<br>METRES |
|----------|----------------------|------------------------|
| 05 07 03 | 0                    | 2.60                   |
| 05 07 10 | 0                    | 2.50                   |
| 05 07 24 | 0                    | 2.60                   |
| 05 07 31 | 0                    | 1.50                   |
| 05 08 03 | 0                    | 1.20                   |
| 05 08 15 | 0                    | 1.70                   |
| 05 08 21 | 0                    | 1.70                   |
| 05 08 27 | 0                    | 3.00                   |
| 05 10 23 | ---                  | ---                    |
| 06 01 14 | ---                  | ---                    |

Appendix IV(1-111)

STATION W20950, SOURCE - STEWART LAKE  
SAMPLING LOCATION - S END LATITUDE 50:38 LONGITUDE 100:16

FROM 85 06 01  
TO 86 01 31

| DATE     | COND<br>US/CM | T.R.<br>MS/L | F.R.<br>MS/L | H.P.R.<br>MS/L | PH<br>UNITS | ALKALINITY<br>MS(CACO3)/L | ALKALINITY<br>MS(MCO3)/L | ALKALINITY<br>MS(MH3)/L | ALKALINITY<br>MS(MH3)/L |
|----------|---------------|--------------|--------------|----------------|-------------|---------------------------|--------------------------|-------------------------|-------------------------|
| 85 07 03 | 786.0         | 630.         | 630.         | 5.1            | 8.40        | 180.                      | 317.                     | 16.                     | 0.                      |
| 85 07 10 | 776.0         | 610.         | 610.         | 5.1            | 8.40        | 170.                      | 366.                     | 26.                     | 0.                      |
| 85 07 24 | 701.0         | 650.         | 650.         | 5.1            | 8.40        | 170.                      | 344.                     | 25.                     | 0.                      |
| 85 07 31 | 803.0         | 610.         | 600.         | 6.             | 8.90        | 170.                      | 344.                     | 34.                     | 0.                      |
| 85 08 08 | 760.0         | 500.         | 580.         | 5.1            | 8.60        | 170.                      | 378.                     | 19.                     | 0.                      |
| 85 08 15 | 781.0         | 550.         | 580.         | 5.1            | 8.75        | 168.                      | 376.                     | 14.                     | 0.                      |
| 85 08 21 | 743.0         | 590.         | 590.         | 5.1            | 8.65        | 168.                      | 361.                     | 12.                     | 0.                      |
| 85 08 27 | 743.0         | 570.         | 570.         | 5.1            | 8.60        | 170.                      | 360.                     | 19.                     | 0.                      |
| 85 10 23 | 782.0         | 700.         | 700.         | 5.1            | 8.35        | 172.                      | 376.                     | 17.                     | 0.                      |
| 86 01 14 | 912.0         | 680.         | 680.         | 5.1            | 8.35        | 232.                      | 254.                     | 2.                      | 0.                      |

| DATE     | CALCIUM<br>MS(CA)/L | MAGNESIUM<br>MS(MG)/L | HARDNESS<br>MS(CACO3)/L | MANGANESE<br>MS(MN)/L | IRON<br>MS(Fe)/L | POTASSIUM<br>MS(K)/L | SODIUM<br>MS(Na)/L | DO<br>MG(O2)/L | TURBIDITY<br>NTU |
|----------|---------------------|-----------------------|-------------------------|-----------------------|------------------|----------------------|--------------------|----------------|------------------|
| 85 07 03 | 46.                 | 74.                   | 417.                    | 0.03                  | 0.02             | 18.                  | 13.                | 9.9            | 0.35             |
| 85 07 10 | 49.                 | 84.                   | 467.                    | 0.05                  | 0.02             | 17.                  | 16.                | ---            | 1.00             |
| 85 07 24 | 45.                 | 81.                   | 444.                    | 0.04                  | 0.02             | 18.                  | 16.                | 0.8            | 0.65             |
| 85 07 31 | 43.                 | 79.                   | 432.                    | 0.05                  | 0.02             | 18.                  | 16.                | 10.0           | 2.00             |
| 85 08 08 | 47.                 | 68.                   | 462.                    | 0.06                  | 0.02             | 18.                  | 15.                | 0.4            | 0.55             |
| 85 08 15 | 47.                 | 65.                   | 466.                    | 0.05                  | 0.03             | 21.                  | 16.                | 0.7            | 1.00             |
| 85 08 21 | 45.                 | 76.                   | 419.                    | 0.05                  | 0.02             | 18.                  | 14.                | 0.9            | 0.75             |
| 85 08 27 | 45.                 | 75.                   | 424.                    | 0.06                  | 0.02             | 17.                  | 15.                | 0.9            | 1.00             |
| 85 10 23 | 48.                 | 80.                   | 446.                    | 0.04                  | 0.02             | 18.                  | 12.                | 11.0           | 1.00             |
| 86 01 14 | 44.                 | 76.                   | 416.                    | 0.03                  | 0.02             | 20.                  | 15.                | 0.6            | 0.75             |

| DATE     | SILICA<br>MS(SIO2)/L | TKN<br>MS(MN)/L | NH3 + NH4<br>MS(NH)/L | NO3-NO2<br>MS(NH)/L | P-TOTAL<br>MS(P)/L | CHLORIDE<br>MS(CL)/L | SULPHATE<br>MS(SO4)/L | CHLORO-A<br>US/L | T-COLI<br>MPN/100 ML |
|----------|----------------------|-----------------|-----------------------|---------------------|--------------------|----------------------|-----------------------|------------------|----------------------|
| 85 07 03 | 11.0                 | 1.20            | 0.01                  | 0.01                | 0.020              | 3.                   | 240.                  | 2.6              | 4                    |
| 85 07 10 | 11.0                 | 1.20            | 0.01                  | 0.01                | 0.020              | 3.                   | 235.                  | 6.1              | 4                    |
| 85 07 24 | 11.0                 | 1.20            | 0.01                  | 0.01                | 0.020              | 4.                   | 232.                  | 5.1              | 0                    |
| 85 07 31 | 13.0                 | 1.30            | 0.00                  | 0.01                | 0.025              | 4.                   | 232.                  | 5.1              | 0                    |
| 85 08 08 | 14.0                 | 1.20            | 0.02                  | 0.01                | 0.030              | 4.                   | 230.                  | 6.1              | 3                    |
| 85 08 15 | 15.0                 | 1.10            | 0.01                  | 0.01                | 0.030              | 4.                   | 235.                  | 7.0              | 23                   |
| 85 08 21 | 14.0                 | 1.20            | 0.03                  | 0.01                | 0.030              | 3.                   | 230.                  | 6.1              | 0                    |
| 85 08 27 | 15.0                 | 1.20            | 0.01                  | 0.01                | 0.020              | 4.                   | 241.                  | 7.0              | 0                    |
| 85 10 23 | 13.0                 | 1.30            | 0.01                  | 0.01                | 0.025              | 6.                   | 230.                  | ---              | ---                  |
| 86 01 14 | 15.0                 | 1.50            | 0.09                  | 0.01                | 0.020              | 4.                   | 200.                  | ---              | ---                  |

| DATE     | F. COLI<br>MPN/100 ML | SECCHI DISC<br>METRES |
|----------|-----------------------|-----------------------|
| 85 07 03 | 0                     | 3.30                  |
| 85 07 10 | 0                     | 2.40                  |
| 85 07 24 | 0                     | 2.70                  |
| 85 07 31 | 0                     | 2.00                  |
| 85 08 08 | 0                     | 1.20                  |
| 85 08 15 | 0                     | 2.00                  |
| 85 08 21 | 0                     | 1.50                  |
| 85 08 27 | ---                   | 3.00 G                |
| 85 10 23 | ---                   | ---                   |
| 86 01 14 | ---                   | ---                   |